Bendix

Service Data

SD-61-4962*

Bendix® Wingman® Advanced™ (FLR10™ Sensor)

(*formerly SD-13-4962)

⚠ WARNING

Improper use of the Bendix® Wingman® Advanced™ system can result in a collision causing property damage, serious injuries, or death.

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix Wingman Advanced system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

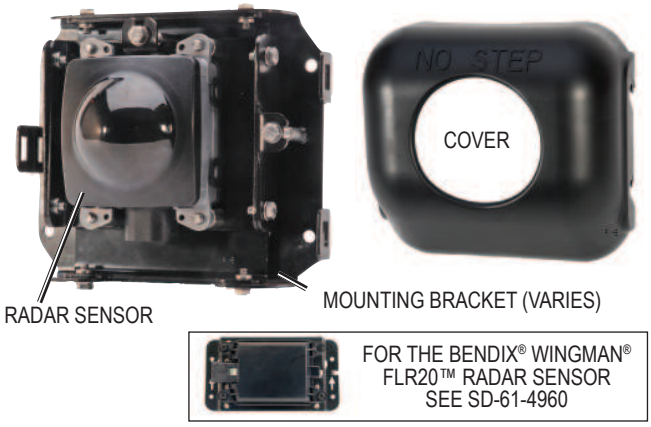

FIGURE 1 - *BENDIX® WINGMAN® FLR10™ RADAR SENSOR AND COVER*

DESCRIPTION

The Bendix® Wingman® Advanced™ system is an integrated combination of three features:

- Adaptive cruise control with braking;
- Alerts (several different types); and
- Collision mitigation technology.

PART ONE: ADAPTIVE CRUISE CONTROL WITH BRAKING

The adaptive cruise control with braking feature is an additional upgrade of ordinary cruise control. When using cruise control, the Wingman Advanced system will maintain the set speed, and also will intervene, as needed, to help maintain a set following distance behind a detected forward vehicle.

Using a radar sensor mounted to the front of the vehicle — with a range of approximately 500 feet — the Wingman Advanced system reacts to detected forward vehicles in the same lane, traveling in the same direction. *See Figure 1.*

The adaptive cruise control with braking feature is designed to help the driver maintain a set following distance between his vehicle and a detected forward vehicle when cruise control is set. *See the gray "Radar Beam" area in Figure 2.*

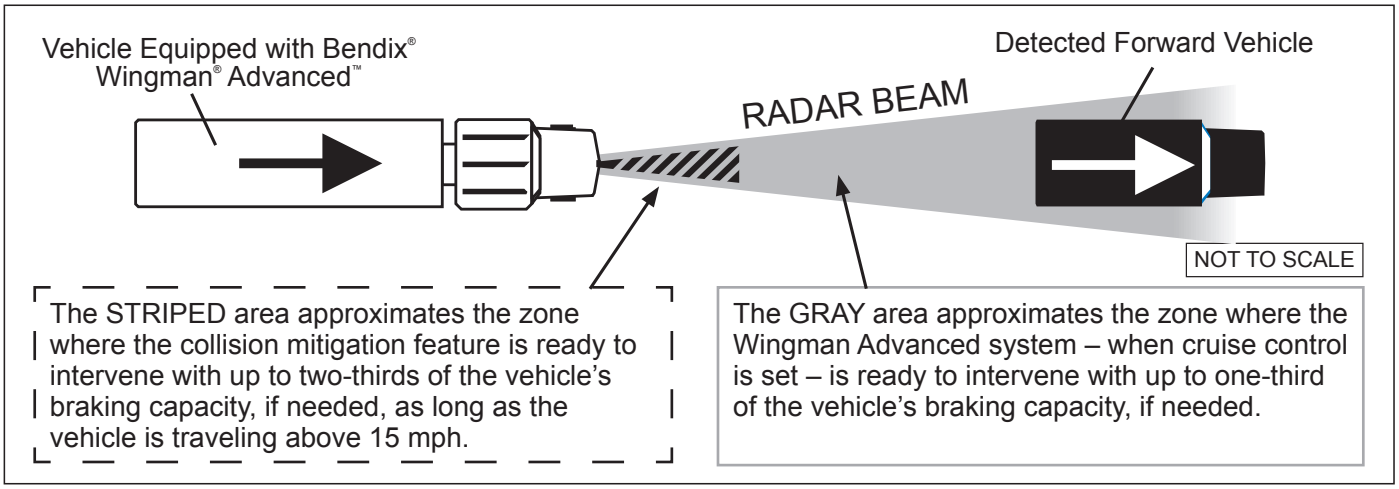
Vehicle Equipped with Bendix® Wingman® Advanced™
Detected Forward Vehicle
RADAR BEAM
NOT TO SCALE
The STRIPED area approximates the zone where the collision mitigation feature is ready to intervene with up to two-thirds of the vehicle's braking capacity, if needed, as long as the vehicle is traveling above 15 mph.
The GRAY area approximates the zone where the Wingman Advanced system – when cruise control is set – is ready to intervene with up to one-third of the vehicle's braking capacity, if needed.

FIGURE 2 - *BENDIX WINGMAN ADVANCED SYSTEM RADAR DETECTION*

GENERAL SAFETY GUIDELINES

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following guidelines should be observed AT ALL TIMES:

- Park the vehicle on a level surface, apply the parking brakes and always block the wheels. Always wear personal protection equipment.
- Stop the engine and remove the ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically-charged components.
- Do not attempt to install, remove, disassemble or assemble a component until you have read, and thoroughly understand, the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
- If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with a Bendix® AD-IS® air dryer system, a Bendix® DRM™ dryer reservoir module, or a Bendix® AD-9si® air dryer, be sure to drain the purge reservoir.
- Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
- Never exceed manufacturer's recommended pressures.
- Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.
- Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
- Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
- Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.
- For vehicles with Automatic Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.
- The power MUST be temporarily disconnected from the radar sensor whenever any tests USING A DYNAMOMETER are conducted on a Bendix® Wingman® Advanced™-equipped vehicle.
- You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.

WARNING

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix Wingman Advanced system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

Once cruise control is set and the system is maintaining a set following distance between you and the vehicle in front:

If the vehicle in front of you slows down below the cruise control's set speed, the Bendix® Wingman® Advanced™ system will intervene and, as necessary, in this order:

(a) reduce the engine throttle; then

(b) apply the engine retarder; then

(c) apply the foundation brakes,

in an attempt to maintain the set following distance behind the vehicle ahead. NOTE: If during the intervention, it is necessary to apply the foundation brakes, the vehicle will not automatically resume the cruise control set speed.

If the vehicle ahead slows below the cruise control's set speed, but then accelerates away, and the Wingman Advanced system did not need to use the foundation brakes, the system will automatically accelerate back to the original cruise control set speed, and again maintain a set following distance behind any detected forward vehicles.

Because the Wingman Advanced system operates along with normal cruise control, all the typical features built into cruise control work as usual. For example, limits imposed by factory-set road speed governors, etc. are fully supported by the Wingman Advanced system.

PART TWO: ALERTS

Bendix Wingman Advanced also assists by giving audible and visual alerts, whether or not cruise control is on. See Pages 8-10 for more information on the three types of alerts the driver may hear and/or see displayed.

PART THREE: COLLISION MITIGATION TECHNOLOGY

See the striped area in Figure 2. The Wingman Advanced collision mitigation technology is designed to be ready to react to the presence of moving vehicles in front of your vehicle (whether or not cruise control is set). Collision mitigation interventions can be up to two-thirds of the vehicle's braking capacity. The system provides the driver with an alert before an intervention occurs. The driver must immediately act to potentially avoid, or lessen the severity of, a collision.

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1.0 OPERATION SECTION

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1.1 IMPORTANT SAFETY INFORMATION

⚠ WARNING

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix Wingman Advanced system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

This vehicle's cruise control must be used only in the same conditions that are normally recommended for ordinary cruise control.

Vehicle manufacturers may use alerts, messages, and dash arrangements that vary from the examples shown here. Consult the vehicle operator's manual for applicable details regarding use and operation.

WHEN NOT TO USE BENDIX® WINGMAN® ADVANCED™ ADAPTIVE CRUISE CONTROL WITH BRAKING

The adaptive cruise control with braking feature in Wingman® Advanced™ is automatically ready when normal cruise control is set.

⚠ CAUTION

This vehicle's cruise control must be used only in the same conditions that are normally recommended for ordinary cruise control. As noted below, there are certain situations when cruise control should *NOT* be used.

• **Inclement Weather/Low Visibility Situations** – Do not use cruise control in inclement weather or low visibility conditions such as rain, snow, smoke, fog, ice or other severe weather conditions that may affect the performance of the Wingman Advanced system.	
• **Dense Traffic** – Do not use cruise control in heavy traffic.	
• **Sharp Curves and Winding Roads** – Do not use cruise control when traveling sharply curved or winding roadways. CAUTION: Road curvature may impact the radar's ability to track vehicles ahead in the same lane.	
• **Entrance or Exit Ramps** – Do not use cruise control when entering or exiting roadways.	
• **Downhill Grades** – Do not use cruise control on downhill grades.	
• **Construction Zones** – Do not use cruise control in construction zones.	
• **Off-Road** – Do not use cruise control in off-road conditions.	
• **Smaller Forward Vehicles** – Smaller vehicles, such as motorcycles, may be difficult for the radar to identify. It is the driver's responsibility to be aware of these types of vehicles and to slow down if necessary.	

Visit www.bendix.com for more information along with any updates to these limitations and restrictions.

AUTOMATIC FOUNDATION BRAKE APPLICATIONS

The vehicle automatically manages foundation brake priorities among the various vehicle systems that use the foundation brakes, such as Bendix® Wingman® Advanced™ system, Bendix® ESP® Electronic Stability Program, Bendix® ATC (Automatic Traction Control) and Bendix® ABS (Antilock Braking System).

NOTE: Cruise control will automatically cancel whenever the Wingman Advanced system applies the foundation brakes. You can verify that your cruise control is disengaged by observing that the cruise-enabled icon is no longer illuminated. You must resume or set cruise control in order to regain normal cruise control functionality and to reengage the adaptive cruise control with braking feature of the Wingman Advanced system.

Additional information, and complete troubleshooting procedures for the Bendix ESP stability system, can be found in the *Bendix Service Data Sheet SD-13-4869*.

1.2 SYSTEM COMPONENTS

The radar sensor (or radar) used in the Wingman Advanced unit is located at the front of the vehicle – either on the bumper or just behind it on a cross-member. *See Figure 3*.

FIGURE 3 - *COMPONENT: RADAR SENSOR*

The radar sensor is pre-aligned at the factory and no adjustment should be needed. If the radar sensor becomes misaligned (or a diagnostic trouble code is issued), either a message – or light on the dash, depending on the vehicle – lets the driver know that service is needed.

The Wingman Advanced system is either fully integrated into the vehicle dashboard, or uses the Bendix® Driver Interface Unit (DIU). *See Figure 4*.

FIGURE 4 - *BENDIX DRIVER INTERFACE UNIT (DIU)*

Although the system functions the same, how the alerts are displayed to the driver can be different. Where a DIU (Driver Interface Unit) is used, all visual, text, and audible indicators and alerts will be provided by the DIU. The DIU allows the volume to be adjusted. *See Appendix B*.

Also see the Indications and Alerts section of this manual on page 16 for more detailed information about the alerts.

NOTE: For some integrated systems, the volume level of the alerts is not adjustable, nor can they be switched off.

1.3 ACTIVATING THE BENDIX® WINGMAN® ADVANCED™ SYSTEM

To have the Wingman Advanced cruise control with braking features of the Wingman Advanced system (engine de-throttle/retard, foundation brake interventions) the vehicle's regular cruise control must be switched on. *See Figure 5 for examples of switches that may be used.*

When the vehicle reaches the desired cruise speed, the driver presses the cruise control set switch to activate the system. The Wingman Advanced system will then engage and help the driver maintain a set following distance behind the vehicle traveling in front.

Once the cruise control speed is set, a cruise-enabled icon (or similar) will illuminate on the instrument panel. If the cruise-enabled or set (or similar) icon does not illuminate, the Wingman Advanced system is not functioning normally. Refer to the vehicle operator's manual to double-check the location of the icon, and for further troubleshooting information.

The driver can switch off the Wingman Advanced system manually by either stepping on the brake pedal or switching off the cruise control.

FIGURE 5 - *EXAMPLES OF CRUISE CONTROL SWITCHES*

IMPORTANT NOTE: Cruise control will automatically cancel whenever Wingman Advanced applies the foundation brakes.

1.4 WHAT TO EXPECT WHEN USING THE BENDIX® WINGMAN® ADVANCED™ SYSTEM

Table 1, parts 1-3, illustrate what to expect from the Wingman® Advanced™ system in various driving situations. Typical system indications and actions to expect from the system are illustrated.

What to Expect (1.4)		
Part One: All driving scenarios (Cruise is either "on" or "off")		
Situation	**Typical System Indication/Alerts**	**Typical System Actions**
A broken-down vehicle is stationary in the lane in which the truck is traveling.	A Stationary Object Alert may be issued up to (three) 3 seconds prior to impact.	None.
A pedestrian, deer or dog runs in front of the truck.	None.	None.
Another vehicle crosses the road perpendicular to your path of travel – such as at an intersection.	None.	None.

TABLE 1 - PART 1 - ***OPERATIONAL SCENARIOS WITH THE BENDIX® WINGMAN® ADVANCED™ SYSTEM***

What to Expect (1.4)		
Part Two: Cruise control "on" and speed "set"		
Situation	**Typical System Indication/Alerts**	**Typical System Actions**
With no detected forward vehicle.	None.	Vehicle maintains set speed.
With a detected forward vehicle.	The cruise control ON indicator is illuminated and the detected forward vehicle icon is illuminated.	The adaptive cruise control with braking feature will maintain the set speed and following distance.
The detected forward vehicle slows moderately.	The Following Distance Alert (FDA) will sound and a visual message/ icon typically appears on the dash screen or Bendix® Driver Interface Unit (DIU) display.	The vehicle will be slowed by (a) reducing throttle; (b) then engaging the engine retarder; and (c) then applying the foundation brakes. ***Note:*** *If the foundation brakes are applied, cruise control is cancelled.*
The detected forward vehicle slows rapidly.	The Impact Alert (IA) warning (continuous tone), will sound and a visual message/icon typically appears on the dash screen or DIU display. The Following Distance Alert may also be heard.	The vehicle throttle will be reduced; the engine retarder engaged; and the foundation brakes applied, in that order. The cruise control feature cancels after the event.
The detected forward vehicle cuts in front of the truck but then speeds away.	Following Distance Alerts may be given to the driver, depending on the exact system configuration that has been set for the vehicle, and how close the vehicle cuts in front.	Vehicle maintains set speed.
Going down a grade with a detected forward vehicle. Cruise control should ***NOT*** be used on downhill grades - see page 3. *(See the CDL manual instructions on proper gear usage for downhill grades.)*	DO NOT USE cruise control on downhill grades.	*DO NOT USE cruise control on downhill grades.*

TABLE 1 - PART 2 - ***OPERATIONAL SCENARIOS WITH THE BENDIX WINGMAN ADVANCED SYSTEM***

NOTE: The system indicators/alerts above are typical, but may vary from the descriptions shown here by vehicle manufacturer, or earlier versions of the Wingman Advanced system.

What to Expect (1.4)		
Part Three: Cruise control NOT "SET", or "OFF"		
Situation	**Typical System Indication/Alerts**	**Typical System Actions**
Your vehicle comes up fast behind a slower-moving detected forward vehicle.	The Following Distance Alert (FDA) will sound and a visual message/icon typically appears on the dash screen or DIU display. Depending on how close your vehicle approaches, the system may initiate an Impact Alert warning.	If a collision is likely to occur, the collision mitigation feature will apply up to two-thirds of the vehicle's braking capacity. **⚠ WARNING** **The driver must immediately act to potentially avoid, or lessen the severity of, a collision.**
The detected forward vehicle slows rapidly.	The Following Distance Alert (FDA), or Impact Alert warning (continuous tone) will sound and a visual message/icon typically appears on the dash screen or DIU display.	If a collision is likely to occur, the collision mitigation feature will apply up to two-thirds of the vehicle's braking capacity. **⚠ WARNING** **The driver must immediately act to potentially avoid, or lessen the severity of, a collision.**

TABLE 1 - PART 3 - *OPERATIONAL SCENARIOS WITH THE BENDIX® WINGMAN® ADVANCED™ SYSTEM*

NOTE: These are typical situations and responses that may occur when using Wingman Advanced. All possible situations and responses are not covered in this table.

1.5 HOW A DRIVER INTERACTS WITH BENDIX® WINGMAN® ADVANCED™

Table 2 illustrates how the Wingman® Advanced™ system will respond to various actions a driver may take when using Wingman Advanced system on the road.

⚠ WARNING

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix® Wingman® Advanced™ system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

How a Driver Interacts with Bendix® Wingman® Advanced™ (1.5)	
Action	**Reaction of Wingman Advanced**
If the driver does this:	**Expect the Wingman Advanced system to do this:**
Steps on the brake. (During a collision mitigation event.)	The driver is always in control and is able to apply full braking power.
Steps aggressively on the accelerator. (During a collision mitigation event.)	The driver is always in control. His/her actions override any Wingman Advanced system actions. Note: If cruise control is engaged, it will be overridden until the accelerator is released; then cruise control will resume the original set speed automatically.
Steps on the brake. (When in cruise.)	Cruise control will be cancelled.
Steps on the accelerator. (When in cruise.)	Cruise control will be overridden until the accelerator is released; then cruise control will resume the original set speed automatically.
Switches on the cruise control.	Nothing. The adaptive cruise control with braking feature will not engage until the driver sets the cruise control speed.
Switches off the cruise control.	The adaptive cruise control with braking feature will turn off; the collision mitigation feature remains active and ready to intervene. The driver will continue to hear all alerts as needed.
Sets the cruise control speed.	The adaptive cruise control with braking feature is automatically activated. Your vehicle maintains a set speed and following distance behind the vehicle ahead.
Covers or blocks the radar.	The Wingman Advanced system performance will be diminished or even disabled and a Diagnostic Trouble Code (DTC) will be set. A blockage will also affect engine cruise control availability.
Uses normal cruise control “+/-” switch.	Vehicle speed increased (+) or reduced (-) to achieve the new set speed while actively maintaining following distance with the vehicle ahead, if one is present within 500 feet.

TABLE 2 - *HOW A DRIVER INTERACTS WITH BENDIX® WINGMAN® ADVANCED™*

NOTE: The system responses above are typical, but may vary from the descriptions shown here by vehicle manufacturer, or earlier versions of the Wingman Advanced system. These are examples of driver actions and typical Wingman Advanced system responses, however this chart does not attempt to cover all possible situations.

THE FORWARD VEHICLE DETECTED ICON

When cruise control is switched on and set and a vehicle ahead of you is detected by the radar, the detected forward vehicle icon — or similar — will illuminate on the vehicle dashboard.

This is an indication to the driver that the Wingman® Advanced™ system is actively managing the distance between your vehicle and the vehicle ahead, and may intervene automatically, if needed.

See Figure 6 for examples.

FIGURE 6 - *FORWARD VEHICLE DETECTED ICONS*

ADJUSTING THE CRUISE CONTROL SPEED

Use the switch(es) provided by the vehicle manufacturer to set your cruise control speed. When adjusted, your set speed will typically be indicated on the vehicle dash, message center, or speedometer.

1.6 FOLLOWING DISTANCE

Following distance refers to the time gap, measured in seconds, between your vehicle and the vehicle ahead. The actual physical distance between the two will vary based on the speeds of both vehicles; however, the set gap will remain the same for all set cruise speeds.

FOLLOWING DISTANCE ADJUSTMENT SWITCH

This optional Wingman® Advanced™ feature, allows the driver to adjust the following distance or time gap. The availability of this feature is determined by the vehicle manufacturer. The switch has an increase or decrease function. Pressing increase (+) will provide a larger following distance, measured in seconds. Pressing decrease (-) will provide a shorter following distance.

1.7 WINGMAN® ADVANCED™ COLLISION MITIGATION FEATURE OPERATION

Whenever your vehicle is traveling at above 15 mph, the Wingman Advanced collision mitigation feature is ready to intervene, if needed. It does not require cruise control to be set. The collision mitigation feature of Wingman Advanced will alert you automatically and apply up to two-thirds of the vehicle's braking capacity, if a collision with the detected forward vehicle is likely to occur. You, the driver, must immediately act to potentially avoid, or lessen the severity of, a collision.

Collision mitigation is ready to intervene as long as no DTCs are active in either the brake system, Wingman Advanced system, or any other contributing vehicle system.

AUTOMATIC FOUNDATION BRAKE APPLICATIONS

The vehicle automatically manages foundation braking priorities among the various vehicle systems that use the foundation brakes, such as Wingman Advanced, Bendix® ESP® (Electronic Stability Program), Bendix®ATC (Automatic Traction Control) and the Bendix® ABS (Antilock Braking System).

1.8 ALERTS AND WARNINGS

The Bendix Wingman Advanced system operates differently compared to other cruise control/forward collision warning systems. It is important for ***YOU*** to fully understand the system's features, especially the driver alerts and warnings.

Three important warnings provided by the Wingman Advanced system are the Following Distance Alert (FDA), Impact Alert (IA), and Stationary Object Alert (SOA). The driver will be alerted by any of the three warnings, whether or not the cruise control is activated.

See Appendix B, Sections 3.0-5.0, for more information about how DIUs communicate alerts.

⚠ WARNING

Any audible and/or visual alert by the system means that your vehicle is too close to the vehicle ahead and the driver must immediately act to potentially avoid, or lessen the severity of, a collision.

IMPACT ALERT (IA)

WARNING

The Impact Alert is the most severe warning issued by the Bendix® Wingman® Advanced™ system. This alert indicates that a collision with the detected forward vehicle is likely and the driver must immediately act to potentially avoid, or lessen the severity of, a collision.

The Impact Alert is ready to alert the driver whenever the vehicle is moving above 15 mph.

When activated, the IA will sound and a visual message/icon typically appears on the dash screen or Bendix® Driver Interface Unit (DIU) display. The actual sound/display method varies by vehicle manufacturer.

NOTE: The Impact Alert is typically accompanied by automatic brake interventions. The Wingman Advanced system will apply up to two-thirds of your vehicle's braking capacity. The driver must apply additional braking, when necessary, to maintain a safe distance from the vehicle ahead.

See Figure 7 for an example of an Impact Alert Icon.

FIGURE 7 - *EXAMPLE OF IMPACT ALERT ICON*

FIGURE 8 - *IMPACT ALERT TEXT AND LIGHT PATTERN AS SEEN ON THE BENDIX® DIU*

FOLLOWING DISTANCE ALERT (FDA)

WARNING

The FDA is ready to alert the driver whenever the vehicle is moving above five (5) mph. If the following distance continues to decrease, the driver will hear more rapid audible alerts. When the FDA reaches its highest level, typically a red LED also illuminates on the instrument cluster. The FDA may be accompanied by a visual alert.

* 1.5 seconds is the system default and may vary by fleet/OEM.

FIGURE 9 - DRIVER INTERFACE UNIT (DIU) SHOWING EXAMPLES OF FOLLOWING DISTANCE ALERTS WITH PROGRESSIVELY FASTER AUDIBLE ALERTS.

Above: Examples of other vehicle manufacturer's displays.

FIGURE 10 - *FOLLOWING DISTANCE ALERT*

STATIONARY OBJECT ALERT (SOA)

WARNING

Stationary Object Alert (SOA) – The Bendix Wingman Advanced system will give up to a three (3) second alert to the driver when approaching a detected, sizable, metallic (radar-reflective), stationary object in your lane of travel. This alert indicates that a collision with a stationary object is likely and the driver must immediately act to potentially avoid, or lessen the severity of, a collision.

CAUTION

The SOA is ready to alert the driver whenever the vehicle is moving above ten (10) mph. The driver should be especially careful when approaching certain types of vehicles or objects. The Wingman® Advanced™ radar may not be able to detect vehicles and objects with limited metal surfaces (such as recreational vehicles, horse-drawn buggies, motorcycles, logging trailers, etc.). *NOTE: Entering a curve may reduce the alert time to less than three (3) seconds.*

FIGURE 11 - *STATIONARY OBJECT ALERT DISPLAYED*

BRAKE OVERUSE ALERT

WARNING

The Bendix® Wingman® Advanced™ system provides a warning when the system is intervening and using the foundation brakes excessively. Overuse of the foundation brakes can lead to the brakes overheating and a potential loss of braking performance caused by brake fade. Using cruise control on downhill runs will cause this alert to be activated.

WARNING

Approach grades as you would normally, with the appropriate gear selected and at a safe speed. Cruise control should *NOT* be used on downhill grades.

When the system detects brake overuse, depending on the vehicle manufacturer, a text message will be displayed on the dashboard and an audible alert will be activated. The driver should intervene immediately.

FIGURE 12 - *BRAKE OVERUSE WARNING*

- Once the brake overuse alert is activated, certain driver interventions that cancel cruise control – like stepping on the brake pedal or switching off cruise – will discontinue the alert. Following an overuse alert, the driver should not reset cruise control for at least 20 minutes. This gives the brakes time to cool down. If the driver chooses to reset cruise control during that 20 minute period, Wingman Advanced interventions will be limited to de-throttling and engine retarder only. The system will automatically disable all Wingman Advanced system foundation brake applications for at least 20 minutes.
- If the system does not detect a driver intervention within 15 seconds after the brake overuse alert sounds, it will shut itself off and set a Diagnostic Trouble Code (DTC). The driver will continue to receive alerts, but ALL Wingman Advanced interventions (de-throttling, engine retarder or brake applications) will be disabled until the next ignition cycle.

Note: In all cases, the driver still has the ability to apply the foundation brakes if necessary. The driver should take care since overheated brakes may reduce the vehicle's braking capability. *(See Appendix B7.0).*

1.9 WINGMAN ADVANCED SYSTEM DIAGNOSTIC TROUBLE CODES

The Wingman Advanced system is monitored and if any malfunction is detected, a Diagnostic Trouble Code (DTC) will be set and the driver will be alerted. The exact alert given depends on the vehicle manufacturer: refer to your vehicle operator's manual and Sections 3 and 4.

1.10 RADAR SENSOR INTERCHANGEABILITY

Many variables must be considered when determining whether or not the radar sensor can be relocated from one vehicle to another vehicle. They include, but are not limited to, the version of the Bendix® ESP® stability system used on the vehicle, the instrument cluster, the vehicle ECU, the engine and the transmission. Contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725, option 2) to determine if this is a viable option.

WARNING

Do not interchange radar sensors without contacting Bendix first!

1.11 ALERT VOLUME

For Wingman Advanced systems installed on vehicles with alerts that come directly through the instrument cluster, audible alert levels are pre-set at the factory and can not be turned off, nor can the volume be adjusted. However, where the Bendix® Driver Interface Unit (DIU) is used, volume adjustment is permitted.

1.12 POTENTIAL FALSE ALERTS

In certain unusual traffic or roadway conditions, Wingman Advanced may issue a false alert. While eliminating all false alerts is not possible, if false alerts occur too frequently (more than twice a day), this may indicate sensor misalignment. Service the system at the earliest opportunity.

Drivers should take into account the road conditions, and any other factors they are encountering, as they choose how to react to any alerts they receive from the Wingman Advanced system.

2.0 MAINTENANCE SECTION

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2.1 GENERAL SAFETY GUIDELINES

See Page 2 of this Service Data Sheet for the General Safety Guidelines.

2.2 EQUIPMENT MAINTENANCE: BRAKE SYSTEM AND ABS FUNCTIONALITY

⚠ CAUTION

Importance of Antilock Braking System (ABS) Maintenance – Optimal Bendix® Wingman® Advanced™ system braking requires a properly maintained ABS system, without any active ABS Diagnostic Trouble Codes (DTCs). Have active DTCs repaired by a qualified technician. Any ABS DTCs will cause Wingman Advanced to deactivate.

⚠ CAUTION

Importance of Brake Maintenance – Optimal Wingman Advanced braking requires properly maintained foundation brakes (drum, wide-drum, or air disc) which meet appropriate safety standards and regulations. Brake performance also requires that the vehicle be equipped with properly sized and inflated tires, with a safe tread depth.

⚠ CAUTION

System Problems – If a problem with the Wingman Advanced system is detected, depending on the vehicle manufacturer, typically there will be a message on the dashboard display. Depending on the type of problem detected, the system will determine if the vehicle may continue normal cruise control functions (without the benefits of Wingman Advanced), or whether all cruise control functions should be disabled until service is performed. The system should be serviced as soon as possible to restore full Wingman Advanced functionality.

2.3 SYSTEM PREVENTIVE MAINTENANCE

The Wingman Advanced system is relatively maintenance free. The key items to keep the system functioning properly include:

1. Keep the radar lens clean and free of obstructions.
2. Inspect for any damage to the bumper or the Wingman Advanced cover, bracket or radar to ensure that the alignment has not been compromised. **Never use the radar unit as a step.**
3. Periodically check the radar alignment.
4. Perform appropriate inspections of the braking system as required by the manufacturer to ensure brakes are in proper working order.
5. Ensure that the tires are properly inflated and that adequate tread is present.

⚠ CAUTION

Radar Inspection – The driver should inspect the radar and mounting bracket regularly and remove any mud, snow, ice build-up, or other obstructions. The installation of aftermarket deer guards, bumper guards, snow plows or similar potential obstructions is not recommended, and could impair the operation of the radar.

⚠ CAUTION

Radar Damage / Misalignment / Tampering - In cases where the bumper and/or radar have sustained any damage, are misaligned, or if you suspect that the radar has been tampered with, do not use the cruise control until the vehicle has been repaired and the radar re-aligned.

2.4 ADDITIONAL SUPPORT AT WWW.BENDIX.COM / 1-800-AIR-BRAKE (1-800-247-2725), OPTION 2

For the latest information, and for free downloads of the Bendix® ACom® Diagnostics software, and its User Guide, visit the Bendix website at: www.bendix.com.

You will also find a current list of compatible RP1210 data link adapters for ABS and the Wingman ACB system.

For direct telephone technical support, the Bendix Tech Team is available at 1-800-AIR-BRAKE (1-800-247-2725), option 2, Monday through Friday, 8:00 A.M. to 6:00 P.M. ET. For assistance, follow the instructions in the recorded message.

The Bendix Tech Team can also be reached by e-mail at: techteam@bendix.com.

3.0 INTRODUCTION TO TROUBLESHOOTING SECTION

Section Index

3.1 Troubleshooting Basics 13

3.2 Narrowing Down the Problem 14-15

3.3 Overview of Possible Issues 16

This section introduces three initial steps to accurately troubleshoot the Bendix® Wingman® Advanced™ system.

We recommend reading this introductory section, as well as the *Troubleshooting/Diagnostics Section (4.0)*, before performing any troubleshooting.

When diagnosing the Wingman Advanced system, a current version of Bendix® ACom® Diagnostics software will be required. This software is available as a free download from www.bendix.com.

3.1 TROUBLESHOOTING BASICS

Which radar sensor is installed?	The Wingman Advanced (FLR10™) system covered in this SD sheet has a black “eyeball” (FLR10) radar sensor.		If your Wingman Advanced system has a flat (FLR20™) radar sensor, use Bendix SD sheet SD-61-4960 instead.	

Troubleshooting Basics (3.1)	
Questions	**Next Steps**
Have the driver run the Power-Up Self-Test.	**Power-Up Self-Test** This is a self diagnostic check, to determine if the system operation is normal.
	1. Park the vehicle. Power off. 2. Put the key into the ignition, and turn to the “ignition power” position. 3. Toggle the cruise control switch at least once, and leave it in the “on” position. Start the vehicle, but do not drive away. 4. **Note that if the cruise control is in the “off” position, or if the vehicle is moving, this test will not run.** 5. The self-test will start after 15 seconds, and takes approximately five (5) seconds to complete. (Note that other vehicle system self-tests, e.g. the ABS “chuff” test, may run during the initial 15 seconds after ignition “on.”) As the Wingman Advanced self-test runs, the driver should hear a short set of beeps. The test checks the engine, transmission, and brake systems to make sure they are communicating. In addition, depending on the vehicle, the test may briefly display a distance alert message and/or cause the Forward Vehicle Detected icon in the instrument cluster to illuminate; this is normal.
Does the driver hear a long warning beep?	If no problem is found and the test is passed, no additional beeps/lamps will be displayed nor will a trouble code be set. If the system has found an issue that will prevent it from functioning properly, **a long warning beep will sound** to alert the driver, and a Diagnostic Trouble Code (DTC) will be logged in the system (typically with a status indicator/dash icon illuminated). For descriptions of all DTCs, *see Section 4.3: Diagnostic Trouble Codes.*
Have the driver describe the system behavior that they believe shows it is not working properly.	When diagnosing the system, especially in cases where there are no diagnostic trouble codes logged, find out which part of the system behavior appears to be operating improperly. *See Section 3.2: Narrowing Down the Problem.*

TABLE 3 - *TROUBLESHOOTING BASICS*

3.2 NARROWING DOWN THE PROBLEM

Use the questions found in Table 3.2 below to help assess if the Bendix® Wingman® Advanced™ system is not performing correctly. Be sure to have a thorough understanding of the system's normal behavior; this will reduce the troubleshooting time. The table provides a guide to basic troubleshooting questions and possible corrective actions. Items *in Italics* cross-reference to the service procedures in this manual to repair the condition described.

If Bendix Tech Team assistance is needed, prior to calling 1-800-AIR-BRAKE (1-800-247-2725), option 2, complete the *Troubleshooting Checklist* (*See Appendix A*), to help reduce the time needed to troubleshoot the system.

Narrowing Down the Problem (3.2)	
Questions	**Next Steps**
Alignment Problems	
Is the radar sensor mounting location (bumper or cross member) damaged? • Does the system seem to lose, or "not hold on to," the forward vehicle when going around curves? • Does the system seem to warn on vehicles in adjacent lanes? • Are there false alerts when passing other vehicles? • Does the system seem to warn late when another vehicle cuts in front of the truck? • Does the system seem to not "see" as far as it "used to", or warn on many more overhead bridges/ signs than previously? • Does the system seem to be inconsistent when tracking forward vehicles?	Re-align the radar sensor vertically and laterally. Use the following procedures: • Section 6.7: *Check Vertical Alignment* and adjust if needed. • Section 6.9: *Check Lateral Alignment* and adjust if needed. • Section 6.2: *Check Radar Sensor Mounting* – The radar needs a solid mounting surface in order to hold the alignment. If the bumper or mounting cross member is damaged, replace it first, then align the radar sensor.
Blocked Radar Sensor Issues	
Is mud, ice, or snow covering the radar sensor? Is anything blocking the view of the radar sensor? ***Also see Appendix E.***	Clean the radar sensor lens immediately. Remove anything blocking the radar sensor then power cycle and read any remaining trouble codes. Read Section 4.3: *Diagnostic Trouble Codes*. If the vehicle's cruise control is set and the radar sensor is blocked by ice, snow, mud, tampering, etc. so that it cannot "see" a forward vehicle, Wingman Advanced will log a diagnostic trouble code (DTC). After the blockage is removed, the DTC will clear automatically. This process also will set a vehicle cruise control DTC which must be cleared with an ignition key cycle. Add a visual check of the radar sensor for blockage to the driver's pre-trip inspection checklist.
Potential False Warnings	
Do false alerts seem to happen in construction zones or going under bridges?	Several road scenarios have a tendency to cause false warnings, including construction zones and bridges. Unless these false warnings are frequent, the system is likely reacting normally. The driver should not set the cruise control in construction zones. If driver complaints persist, continue asking questions to more narrowly define the driving condition presenting the problems. Review proper operating conditions in the operator's manual.
Other Questions	
Has the system worked properly in the past and is not working correctly now?	This is a good indication that something has changed, such as misalignment of the radar sensor. Review questions listed above with the driver to further diagnose the problem.
Has the radar sensor been changed recently?	If so, the new radar sensor may be incompatible with the vehicle. Follow Section 1.10: *Radar Sensor Interchangeability* procedure and check system trouble codes with Bendix® ACom® Diagnostics software. Read Section 4.3: *Diagnostic Trouble Codes.*

TABLE 4 - *NARROWING DOWN THE PROBLEM* *(PAGES 14-15)*

Narrowing Down the Problem (3.2)	
Questions	**Next Steps**
Does the mounting bracket look damaged or tampered with?	Other than expected surface scratches or some discoloration over time, there should be no visible damage to the radar sensor bracket assembly. If so, realign the radar sensor vertically and laterally. If radar sensor alignment can not be held in place, the bracket assembly must be replaced. Verify the bumper is not damaged. • Check the *Vertical Alignment (6.7)* and adjust if needed. • Check the *Lateral Alignment (6.9)* and adjust if needed. The Radar Sensor Mounting - The radar sensor needs a solid mounting surface in order to hold the alignment. If the bumper or mounting cross member is damaged, replace it first, then align the radar sensor.
Did the radar sensor currently on the vehicle come from another vehicle?	The radar sensor may be incompatible with the new vehicle. Follow Section 1.10: *Radar Sensor Interchangeability* procedure and check system trouble codes with Bendix® ACom® Diagnostics software. Read Section 4.3: *Diagnostic Trouble Codes.*
With cruise control set, does the system consistently apply the foundation brakes when a forward vehicle slows?	This is normal operation. Continue asking the driver questions to diagnose the problem. The radar sensor may be blocked or misaligned. The service technician will need to check trouble codes as well. • Check the *Vertical Alignment (6.7)* and adjust if needed. • Check the *Lateral Alignment (6.9)* and adjust if needed. The Radar Sensor Mounting - The radar sensor needs a solid mounting surface in order to hold the alignment. If the bumper or mounting cross member is damaged, replace it first, then align the radar sensor. Read Section 4.3: *Diagnostic Trouble Codes.*
Does a diagnostic trouble code (DTC) seem to occur when driving through the desert or in barren areas (no road signs, trees or vehicles)?	In normal operation, the adaptive cruise control with braking feature of Bendix® Wingman® Advanced™ system may “go dormant” if it hasn’t detected a metallic object after a pre-determined period. This is rare, but most likely to occur when driving in deserts or barren areas. If the system does “go dormant,” Wingman Advanced provides a visible warning to the driver. In addition, the vehicle also will drop out of cruise mode, providing an audible and/or visual warning to the driver as well. The driver must actively re-engage the vehicle’s cruise control. Once the desired cruise speed is set, the adaptive cruise control with braking feature of Wingman Advanced will resume operation. When metallic objects are again detected by the Wingman radar sensor, the trouble code previously recorded in the Wingman system will clear automatically.
Does the system seem to disengage after an automatic braking event?	This is normal operation. The driver must set or "resume" the cruise control once again to regain the following distance function.
Does cruise control disengage sometimes when the brakes come on and not at other times?	This is normal operation. When traveling with lightly loaded trailers, or “bobtail”, the adaptive cruise control with braking feature of Wingman Advanced may continue to function even after an automatic brake application. No driver input is needed.
Does the connector or wiring appear damaged?	Wires can become corroded if the radar sensor is not plugged in properly. Clean the connectors on the wire harness, as well as the radar sensor, and reattach. If wires are chaffed, replace the wire harness. Also, check for trouble codes. Read Section 4.3: *Diagnostic Trouble Codes,* and Section 4.8: *Troubleshooting Wiring Harnesses*.
Does the system generate a diagnostic trouble code going down a grade, but the code goes away later?	This is normal operation. The adaptive cruise control with braking feature of Wingman Advanced is not intended to be used on grades. If the system detects this, it will generate a diagnostic trouble code (DTC). Verify there are no diagnostic trouble codes. Proper downgrade driving techniques should be used. Read Section 4.3: *Diagnostic Trouble Codes*.
Does the radar sensor have noticeable damage beyond normal discoloration or surface scratches?	The radar sensor and bracket are very durable. However, if the radar sensor housing or lens is cracked or broken, immediately look for trouble codes via a current release of Bendix ACom Diagnostics and replace the damaged radar sensor. Read Section 4.3: *Diagnostic Trouble Codes*, and Section 6.2: *Radar Sensor Mounting*.

TABLE 4 - *NARROWING DOWN THE PROBLEM* *(PAGES 14-15)*

3.3 OVERVIEW OF POSSIBLE ISSUES

Some customer issues are actually misunderstandings of how the Bendix® Wingman® Advanced™ system performs normally. Use Table 5 below to learn the causes of potential issues if Wingman Advanced is not performing correctly. Some issues can be investigated by a visual inspection. Others may cause a diagnostic trouble code (DTC) to be logged: *See Section 4.3: Diagnostic Trouble Codes*.

Overview of Possible Issues (3.3)	
Issue	**Description**
System familiarity	Verify the system functionality. Is it operating normally or not? Drivers who are unfamiliar with the system may report dissatisfaction over the way it beeps or how it activates the brakes. Use Section 3.0: *Introduction to Troubleshooting*, Section 4.3: *Diagnostic Trouble Codes* and Section 3.1: *Questions to Ask the Driver* to verify if the system is functioning normally; then continue.
DTCs caused by temporary operating conditions	Some Diagnostic Trouble Codes (DTCs) indicate a temporary condition and will clear when that condition is no longer present. If these persist, further investigation is warranted. *See Section 3.1: Troubleshooting Basics*.
Radar sensor misalignment	If the performance of the system seems to be erratic or unpredictable, the radar sensor could be misaligned and may need to be aligned both vertically and laterally. If there is a DTC set or if the system does not function, the radar sensor may be severely misaligned and Wingman Advanced will not operate until this is corrected. *See Section 6.1: Vehicle Applications*. Inspect the front of the vehicle. If (a) it has been damaged, or (b) if the vehicle does not track straight, either of these conditions must be repaired before troubleshooting Wingman Advanced.
Radar sensor blocked	If the system doesn't seem to work at all, the radar sensor is probably blocked. A DTC will also be set. Visually inspect it, clear the blockage, turn the ignition on and run through a power cycle.
Vehicle diagnostic trouble codes (DTCs)	The Wingman Advanced system will not operate and will set a DTC if any of the following vehicle systems also show a DTC: engine, engine cruise, instrument cluster, Bendix® ABS, Bendix® ATC, Bendix® ESP®, or transmission. These components must be repaired and cleared of DTCs before troubleshooting Wingman Advanced. (*NOTE: Clearing the vehicle DTCs may be the only step needed to reestablish full Wingman Advanced functionality. See Section 4.4: Clearing Diagnostic Trouble Codes (DTCs).*
Damaged radar sensor or bracket	If the vehicle has been in an accident, it is likely the radar sensor will need to be re-aligned or replaced. Inspect the radar sensor lens and housing for damage. Radar sensor discoloration or small scratches may be acceptable. Significant damage will require radar sensor replacement. Regardless of the exterior condition, check for diagnostic trouble codes outlined in the Section 4.3: *Diagnostic Trouble Codes (DTCs)* to determine if radar sensor replacement is necessary.
Damaged connector or wiring	Visually inspect the connector and wire harness for corrosion or chaffing. Refer to Section 4.5: *Troubleshooting Diagnostic Trouble Codes: Power Supply* of this document for additional troubleshooting.
J1939 network problems	If the entire system is non-functional, it may be a J1939 network problem. Follow the instructions in Section 4.6: *Serial Data (J1939) Communications Link*.
Power to radar sensor problems	If the entire system is non-functional, another likely cause may be a lack of power to the radar sensor. Follow the instructions in Section 4.5: *Troubleshooting Diagnostic Trouble Codes: Power Supply.*

TABLE 5 - ***REVIEW OF POSSIBLE ISSUES***

4.0 TROUBLESHOOTING/ DIAGNOSTICS SECTION

Section Index

4.1 Bendix® ACom® Diagnostics Software 17
4.2 Reading Diagnostic Trouble Codes (DTCs) . . 18
4.3 Table of DTCs and Actions to Take 19-22
4.4 Clearing DTCs 23
4.5 DTCs: Power Supply 23
4.6 DTCs: J1939 Communications Link. 23
4.7 (J1939) Test Procedure 23
4.8 Troubleshooting Wiring Harnesses 24

IMPORTANT NOTE: All vehicle diagnostic trouble codes related to the engine, transmission, instrument cluster, engine cruise control and Bendix® ABS, ATC or ESP® systems must first be resolved, with no trouble codes present during the vehicle operation while in cruise control, before attempting to diagnose Bendix® Wingman® Advanced™ diagnostic trouble codes.

4.1 BENDIX® ACOM® DIAGNOSTICS SOFTWARE

Bendix® ACom® Diagnostics is a PC-based software program available as a free download from the Bendix web site (www.bendix.com) or on a CD from the online Bendix Literature Center (order BW2329). This software provides the technician with access to all the available ECU diagnostic information and configuration capability. For Bendix® Wingman® Advanced™ diagnostics, use a current version of ACom Diagnostics.

FIGURE 13 - BENDIX® *ACOM® DIAGNOSTICS SOFTWARE*

STARTING ACOM® DIAGNOSTICS

The Bendix ACom Diagnostics software can be started from the desktop shortcut, or from the main Windows® screen with "Start-Programs-Bendix-ACom® Diagnostics." *See Figure 14 and also* ***Appendix C***. To begin, the technician selects "Wingman" from the Starter screen, then "Start with ECU" from the Diagnostic Control panel.

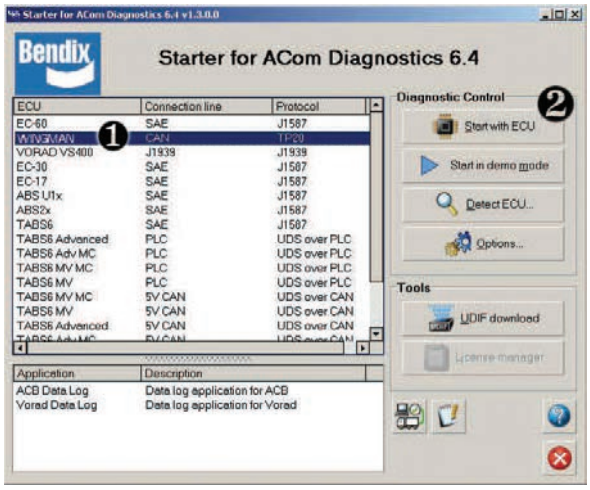


FIGURE 14 - *STARTING BENDIX® ACOM® DIAGNOSTICS SOFTWARE*

NOTE: When using ACom Diagnostics for the first time, the service technician will be asked to select the communication adapter for both the Wingman Advanced and Bendix® *EC-60™ controllers. While both controllers will use the same physical adapter, the technician will need to indicate which communication protocol to use for each. Once a successful connection has been made, these steps will no longer be necessary.*

The Bendix® ACom® Diagnostics for ABS User Guide is available for download at www.bendix.com and should be used as a reference to all functions of the ACom service tool.

In general, the protocol for Wingman® Advanced™ is described as CAN or CAN 250. (*See Figure 15 for an example of an adapter compatible with Wingman Advanced*). The Bendix® EC-60™ controller protocol will be described as J1708.

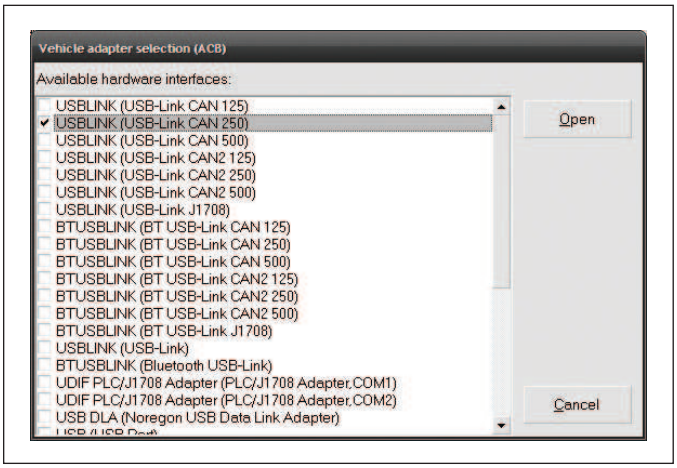

Vehicle adapter selection (ACB)
Available hardware interfaces:
USBLINK (USB-Link CAN 125)
USBLINK (USB-Link CAN 250)
USBLINK (USB-Link CAN 500)
USBLINK (USB-Link CAN2 125)
USBLINK (USB-Link CAN2 250)
USBLINK (USB-Link CAN2 500)
USBLINK (USB-Link J1708)
BTUSBLINK (BT USB-Link CAN 125)
BTUSBLINK (BT USB-Link CAN 250)
BTUSBLINK (BT USB-Link CAN 500)
BTUSBLINK (BT USB-Link CAN2 125)
BTUSBLINK (BT USB-Link CAN2 250)
BTUSBLINK (BT USB-Link CAN2 500)
BTUSBLINK (BT USB-Link J1708)
USBLINK (USB-Link)
BTUSBLINK (Bluetooth USB-Link)
UDIF PLC/J1708 Adapter (PLC/J1708 Adapter,COM1)
UDIF PLC/J1708 Adapter (PLC/J1708 Adapter,COM2)
USB DLA (Noregon USB Data Link Adapter)
Open
Cancel

FIGURE 15 - *BENDIX® ACOM® DIAGNOSTICS SOFTWARE - HARDWARE INTERFACE SCREEN*

4.2 READING DIAGNOSTIC TROUBLE CODES (DTCs)

If the system generates a Diagnostic Trouble Code (DTC), where a lamp or icon is illuminated on the instrument cluster, then a current version of ACom Diagnostics software is required. Select “Wingman” from the starter screen, then “Start with ECU”. Click “DTC” to show the diagnostic trouble codes. ***See Appendix C for screen shots.*** *See Section 4.3 for a complete table showing DTCs and troubleshooting information.*

4.21 READING THE SYSTEM SOFTWARE VERSION

If during troubleshooting, you are asked for the Wingman Advanced software version, the number is found on the “Wingman Advanced Status” tab. *See Figure 16. Also, see Section 5.1 for other system indicators.*

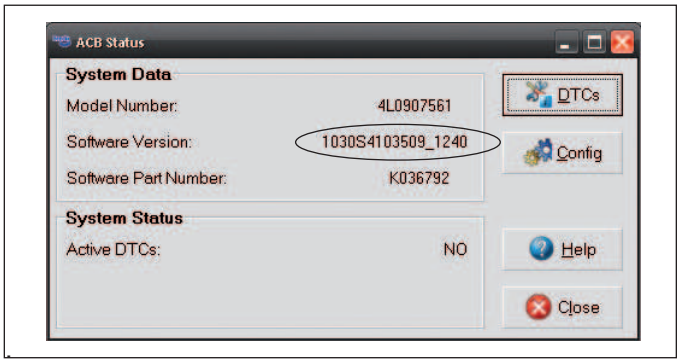


FIGURE 16 - *BENDIX ACOM DIAGNOSTICS SOFTWARE - STARTER SCREEN SHOWING SOFTWARE VERSION*

4.3 TABLE OF BENDIX® WINGMAN® ADVANCED™ DIAGNOSTIC TROUBLE CODES (DTCs)

See Table 6 below:

Table of Diagnostic Trouble Codes (DTCs), Causes and Recommended Actions (4.3)	
DTC	**Actions**
40 - Short to ground 41 - Short to battery Voltage too high (includes DTCs 89, 92) Voltage too low (includes DTCs 90, 91)	**Possible causes:** These trouble codes result from incorrect ignition, battery supply voltage, or wiring harness issues as measured at the radar sensor. **Review the following sections:** • 4.5: *Ignition Voltage Too Low* • 4.5: *Ignition Voltage Too High* • 4.5: *Power Supply Tests* • 4.8: *Troubleshooting Wiring Harnesses* **Perform the following:** • Verify ignition supply voltage to the radar sensor is between 9 to 16 VDC. • Visually check for damaged or corroded connectors. • Visually check for damaged wiring. • Clear the Wingman® Advanced™ trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
55 - Maximum alignment value is reached 56 - Fast alignment value is reached 57 - Slight alignment value is reached (This trouble code will not cause Wingman Advanced to disable. Loss of performance following a vehicle or following distance alerts may be observed.)	**Possible causes:** Radar sensor OUT OF ALIGNMENT **Review the following sections:** • 6.9: *Check Lateral Alignment* • 6.10: *Adjust Lateral Alignment* • 6.11: *Reset the Alignment Value* **Perform the following:** Clear the Wingman Advanced trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error returns, call Bendix for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
81 - Voltage too high 82 - Voltage too low 83 - Invalid Temperature 84 and 85 - Temperature too high 94 - Voltage too high 95 and 96 - Voltage too low (All) Internal radar sensor errors: 1-39, 42-54, 58-80, 86-88, 93, 97-143, 145-151, 154, 194-196 152 - Transmission ratio learning process not completed	**Possible causes:** Some error conditions may occur at extreme high or low temperatures. These trouble codes must be diagnosed with the ambient temperature above 32°F (0°C). **Perform the following:** • Clear the Wingman Advanced trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
144 - Vehicle is not providing expected deceleration during engine retarder or foundation braking	**Possible causes:** Brake system and/or engine retarder are not performing as they should. **Perform the following:** • Check the trouble codes for the engine, and engine retarder. • Inspect brake mechanical and pneumatic system for proper operation. • Clear the Wingman Advanced trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.

TABLE 6 - *DIAGNOSTIC TROUBLE CODES* *(PAGES 19-22)*

Table of Diagnostic Trouble Codes (DTCs), Causes and Recommended Actions (4.3)	
DTC	**Actions**
153 - J1939 All vehicle communications lost 155 - J1939 All vehicle communications lost 157 - J1939 signal error: ABS fully operational 158 - J1939 signal error: EBS brake switch 159 - J1939 signal error: ABS active 160 - J1939 signal error: ASR engine control/ ASR brake control active 161 - J1939 signal error: ABS based wheel speed 163 - J1939 signal error: Foundation brake use 165 - Error in yaw rate signal 168 - J1939 signal error: Actual retarder percent torque 169 - J1939 signal error: Actual retarder percent torque 170 - J1939 signal error: Actual retarder percent torque 171 - J1939 signal error: Driver demand retarder percent torque 172 - J1939 signal error: Driver demand retarder percent torque 173 - J1939 signal error: Driver demand retarder percent torque 174 - J1939 signal error: Gross combination vehicle weight 175 - J1939 signal error: Cruise control enable switch 187 - J1939 signal error: Engine speed 188 - J1939 signal error: Actual engine percent torque 189 - J1939 signal error: Nominal friction percent torque 190 - J1939 signal error: Driver's demand: engine percent torque 191 - J1939 signal error: Accelerator pedal position 1 192 - J1939 signal error: Engine reference torque 197 - J1939 signal error: CC active 198 - J1939 signal error: CC set speed	**Possible causes:** J1939 missing signal on the communication link, or the source of the signal is indicating an error in the signal. **Review the following sections:** • 1.10: *Radar Sensor Interchangeability* • 4.6: *J1939 Serial Data Communications Link* • 4.7: *J1939 Engine Communications Test Procedure* • 4.7.1: *J1939 Troubleshooting Procedure* • 4.8*: Troubleshooting Wiring Harnesses* **Perform the following:** • Check for loss of data communications. • Check for damaged or reversed J1939 wiring. • Check for damaged or corroded connectors. • Check for other devices inhibiting J1939 communications. • With the power off, check the resistance across connector pins (60 ohm). • Check the reverse polarity of J1939 communication circuits at the engine, the ABS and the radar sensor, and at the harness interconnections. • Check the source of the signal to identify why the signal has an error. • Check the engine, engine retarder, and ABS for trouble codes using the manufacturer's diagnostic procedures. Either the engine, engine retarder, or the ABS are the source of the signal. If the signal is in error, then the issue is from the radar sensor or switch input to one of these controllers. The signal with the trouble code may be computed from one or more inputs to these other controllers and may use an additional J1939 signal from another controller. The controller that broadcasts the signal must be investigated first, but the origin of the signal could be another component. Some examples are gross vehicle weight and various engine torque signals. • Clear the Bendix® Wingman® Advanced™ system diagnostic trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs).* • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
156 - ABS off-road switch is turned on	**Perform the following:** Check the trouble codes for the engine, and engine retarder. Inspect and troubleshoot the cruise control system wiring, switches, etc. for proper operation. • Clear the Wingman Advanced DTCs using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2. *NOTE: Wingman Advanced is disabled when the ABS off-road switch is ON. However, the engine cruise control may still operate. This DTC will result in the engine cruise control being de-activated.*

TABLE 6 - ***DIAGNOSTIC TROUBLE CODES*** *(PAGES 19-22)*

Table of Diagnostic Trouble Codes (DTCs), Causes and Recommended Actions (4.3)	
DTC	**Actions**
162 - DTC showing a problem in the interface of the Wingman® Advanced™ brake system	**Possible causes:** • One or more components within the Bendix® EC-60™ ABS or ESP® stability system have active trouble codes that need to be diagnosed and corrected. In this case, inspect the vehicle's mechanical and pneumatic brake system for proper operation. Correct the issues found in the Bendix ABS or ESP systems and clear all trouble codes before proceeding to the Wingman Advanced system. • The controller is recognizing that there are components installed that have part numbers incompatible with the current system configuration. (For example, when a technician attempts to install a more recent radar sensor onto a vehicle with an earlier Wingman Advanced or ACB system.) Contact the dealer — or call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 — for the correct part number to use, or the re-programming steps to take for the newer part number to be accepted. **After addressing the possible causes:** • Clear the Bendix® Wingman® Advanced™ system DTCs using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
164 - Wingman Advanced braking overuse	**Possible causes:** The system was used improperly, such as on grades. **Review the following sections:** Section 1.8: Alerts and Warnings (*Brake Overuse Alert description), also Appendix B7.0* **Perform the following:** • Check the trouble codes for the engine, and engine retarder. • Clear the Wingman Advanced trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
186 - J1939 Outside air temperature signal not available or signal in error. (This trouble code alone will not cause Wingman Advanced to disable. The heater on the lens of the radar sensor will not operate and will not prevent ice or snow build up. The radar sensor may become blocked and then Wingman Advanced will disable, logging a trouble code 201.)	**Review the following sections:** • 4.6: *J1939 Serial Data Communications Link* • 4.7: *J1939 Engine Communications Test* • 4.8: *J1939 Troubleshooting Procedure Wiring Harnesses* • *Diagnostic Trouble Code 201* in Table 6 **Perform the following:** Check for loss of data communications. • Check for damaged or reversed J1939 wiring. • Check for damaged or corroded connectors. • Check for other devices inhibiting J1939 communications. • With the power off, check the resistance across connector pins (60 ohm) J1939. • Check the reverse polarity of J1939 communications circuits at engine, ABS, and radar sensor and at harness interconnections. • Check the source of the signal for why the signal has an error. • Check engine, and vehicle for trouble codes using the manufacturers diagnostic procedures. The engine, or a vehicle controller may be the sources of the signals. If the signal is in error, then the issue is from the radar sensor input to one of these controllers. Clear the Wingman Advanced trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes*. If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.

TABLE 6 - *DIAGNOSTIC TROUBLE CODES* *(PAGES 19-22)*

Table of Diagnostic Trouble Codes (DTCs), Causes and Recommended Actions (4.3)	
DTC	**Actions**
193 - J1939 signal error: Reference velocity unavailable	**Possible causes:** One or more components within the Bendix® EC-60™ ABS, or ESP® stability system have active trouble codes that need to be diagnosed and corrected. **Perform the following:** • Inspect the brake mechanical and pneumatic system for proper operation. Correct any issues found in the ABS or ESP systems. (*See Bendix Service Data sheet SD-13-4869 for more information.*) Clear all trouble codes before proceeding to the Wingman Advanced system. • Clear the Bendix® Wingman® Advanced™ system trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
199 - Wingman Advanced self disable Some system, signal or component caused the Wingman Advanced to be disabled. Engine cruise control is unavailable and should not operate when the Wingman Advanced is disabled.	**Perform the following:** Check the trouble codes for the engine, and engine retarder. Inspect and troubleshoot the cruise control system wiring, switches, etc. for proper operation. • Clear the Wingman Advanced trouble codes by cycling the power. Start the engine. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
201 - Radar sensor lens is dirty or blocked 202 - Forward vehicle is lost or too close to radar sensor	**Possible causes:** These trouble codes may arise from infrequent conditions that could occur normally. **Perform the following:** • Check for lens obstruction. Clean dirt or packed snow or ice from the lens if present. • Clear the Wingman Advanced trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
203 - Wingman Advanced and ABS have a mismatch of the Collision Mitigation Configuration	**Possible causes:** • The controller is recognizing that there are components installed that have part numbers incompatible with the current system configuration. (For example, when a technician attempts to install a more recent radar sensor onto a vehicle with an earlier Wingman Advanced or ACB system, or a replacement ECU is programmed incorrectly for this vehicle's system.) Contact the dealer or call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for the correct part number to use, or the reprogramming steps to take for the newer part number to be accepted. **After addressing the possible causes:** • Clear the Bendix Wingman Advanced trouble codes using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, call the Bendix Tech Team for assistance at 1-800-AIR-BRAKE (1-800-247-2725), option 2.

TABLE 6 - ***DIAGNOSTIC TROUBLE CODES*** *(PAGES 19-22)*

4.4 CLEARING DIAGNOSTIC TROUBLE CODES (DTCs)

This procedure must be used when troubleshooting the diagnostic trouble codes shown in Table 6.

Clear the Wingman® Advanced™ system Diagnostic Trouble Codes (DTCs) using the Bendix® ACom® service tool. Click the "Clear" button located on the "Read/Clear Fault Codes" screen. Using ignition power only, power off the vehicle for at least 1 minute. Next start the engine and run it at idle for at least 15 seconds.

Drive the vehicle and, on a test track or suitable section of roadway, engage the cruise control to verify proper operation.

If the error returns, call Bendix at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for assistance.

4.5 TROUBLESHOOTING DIAGNOSTIC TROUBLE CODES: POWER SUPPLY

IGNITION VOLTAGE TOO LOW

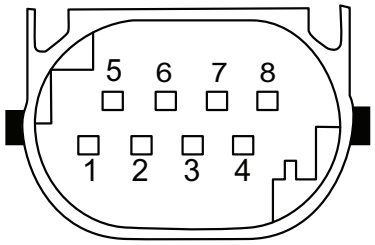
Measure the ignition voltage under load. Ensure that the ignition voltage is greater than 10 VDC (volts DC). Check the vehicle battery and associated components. Inspect for damaged wiring, damaged or corroded connectors and loose connections. Check the condition of the fuse.

IGNITION VOLTAGE TOO HIGH

Measure the ignition voltage. Ensure that ignition voltage is not greater than 16 VDC. Check the vehicle battery and associated components. Inspect for damaged wiring, damaged or corroded connectors and loose connections.

POWER SUPPLY TESTS

1. Take all measurements at the radar sensor harness connector.
2. Place a load (e.g. 1157 stop lamp) across the supply voltage and ground connection. Measure the voltage with the load. The supply voltage on pin 8 to ground should measure between 10 to 16 VDC (volts DC).
3. Check for damaged wiring, damaged or corroded connectors and loose connections.
4. Check the condition of the vehicle battery and associated components. Ensure the connection to ground is secure and tight.
5. Using the procedures described by the vehicle manufacturer, check the alternator output for excessive noise.



Power Supply Pin Codes (4.5)

Pin #	Designation	Description
1	GND (-)	Radar Sensor Ground
2	CAN-H	J1939 High
3	CAN-L	J1939 Low
4	NC	No Connection
5	NC	No Connection
6	NC	No Connection
7	NC	No Connection
8	IGN (+)	Supply Voltage
NOTE: View from pin side		

TABLE 7 - *POWER SUPPLY PIN CODES*

4.6 SERIAL DATA (J1939) COMMUNICATIONS LINK

Check for a loss of communications between the Bendix® Wingman® Advanced™ system radar sensor, the ABS controller, the engine ECU, and other devices connected to the J1939 link. Check for damaged or reversed J1939 wiring. Check for corroded or damaged connectors and loose connections. Using procedures described by the vehicle manufacturer, verify the presence of the engine ECU and the ABS controller on the J1939 link.

Verify the engine ECU configuration. Check for other devices inhibiting J1939 communications.

4.7 ENGINE COMMUNICATIONS (J1939) TEST PROCEDURE

The Bendix Wingman Advanced system requires several J1939 messages from the engine ECU to control the engine and retarder torque for distance control and braking. The Wingman Advanced system will set a diagnostic trouble code if one of these messages is not present.

Use the engine manufacturer's diagnostic test procedures to verify that there are no errors present in the engine that may prevent the Wingman Advanced system from controlling the engine or retarder torque.

4.7.1 J1939 TROUBLESHOOTING PROCEDURE

1. Take all measurements at the harness connector unless otherwise indicated.

   CAUTION: DO NOT INSERT PROBES INTO THE BACK SIDE OF THE CONNECTOR AS THIS WILL DAMAGE THE SEAL AROUND THE WIRE.

   CAUTION: DO NOT INSERT ANY PROBE INTO THE PIN ON THE MATING CONNECTOR OF THE RADAR SENSOR THAT IS GREATER THAN 0.62 MM DIAMETER OR SQUARE. THIS WILL DAMAGE THE CONNECTOR PIN AND REQUIRE REPLACEMENT OF THE HARNESS.

2. Check for damaged or reversed J1939 wiring.

   If the J1939 HIGH or J1939 LOW wiring circuits are damaged, such as shorting together, the entire J1939 link will be lost. The problem may be intermittent, enabling the J1939 link to operate normally sometimes. In that event, multiple diagnostic trouble codes will be logged in multiple engine and vehicle controllers.

   If the J1939 HIGH and J1939 LOW wiring circuits are reversed, communication over the entire J1939 link will not be lost. Only those devices that are outside of the problem point from other devices will not receive, or be able to transmit, data messages.

3. Check for corroded or damaged wiring connector problems such as opens or shorts to voltage or ground.

   If the connector terminals are corroded, this may be an indication of water intrusion into the wiring system and possibly into the radar sensor. Replacement of the entire harness is recommended. If the terminals of the radar sensor are corroded, replacement of the radar sensor is recommended.

4. Check for other J1939 devices which may be inhibiting J1939 communication. The service technician should consult the vehicle manufacturer's procedures for other J1939 troubleshooting procedures. The device's power should be removed and measurements made at the ECU pins for shorts to ground and power pins and resistance between the J1939 HIGH or J1939 LOW input circuits.

5. Unplug the radar sensor. With the ignition switch off, measure the resistance (ohms) using a multimeter between harness pins 2 and 3. The reading should be approximately 60 ohms. If it is not, the vehicle wiring should be investigated using procedures described by the manufacturer.

6. Unplug the radar sensor. With the ignition switch off, using a multimeter, measure the resistance in ohms, between harness pins 2 and ground. The measurement should indicate an open circuit or very high resistance. If this is not the case, the vehicle wiring should be investigated using procedures described by the manufacturer.

7. Unplug the radar sensor. With the ignition switch off, using a multimeter, measure the resistance in ohms, between harness pins 3 and ground. The measurement should indicate an open circuit or very high resistance. If this is not the case, the vehicle wiring should be investigated using procedures described by the manufacturer.

4.8 TROUBLESHOOTING WIRING HARNESSES

All wire harness connectors must be properly seated to maintain environmental seals. Push the mating connector until it seals with a click. When replacing an Advanced radar sensor, check that the wire harness connector is free of corrosion before plugging into a new radar sensor. Check for corroded or damaged wiring connector problems such as opens or shorts to voltage or ground.

If the connector terminals are corroded, this may be an indication of water intrusion into the wiring system and possibly into the radar sensor. Replacement of the entire harness is recommended. If the terminals of the radar sensor are corroded, replacement of radar sensor is recommended.

5.0 OTHER SYSTEM FEATURES SECTION

Section Index

5.1 Reading Bendix® Wingman® Advanced™ System Key Indicators 25

5.2 Diagnostic Trouble Code (DTC) Self-Clearing 25

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5.1 READING BENDIX® WINGMAN® ADVANCED™ SYSTEM KEY INDICATORS

To check the Bendix Wingman Advanced system key indicators such as software version number, use a current version of Bendix® ACom® Diagnostics software. From the main menu of ACom Diagnostics software, the technician highlights Advanced, then clicks “Start with ECU”. The Advanced Status screen will appear. Clicking “Config” will display the key system indicators. *See Section 4.21 for an example of reading the software version. See Figure 17 for an example of ACom software configuration information. See Appendix D.*

NOTE: ACom Diagnostics is also used for troubleshooting Bendix® ESP®, ATC, and ABS systems.

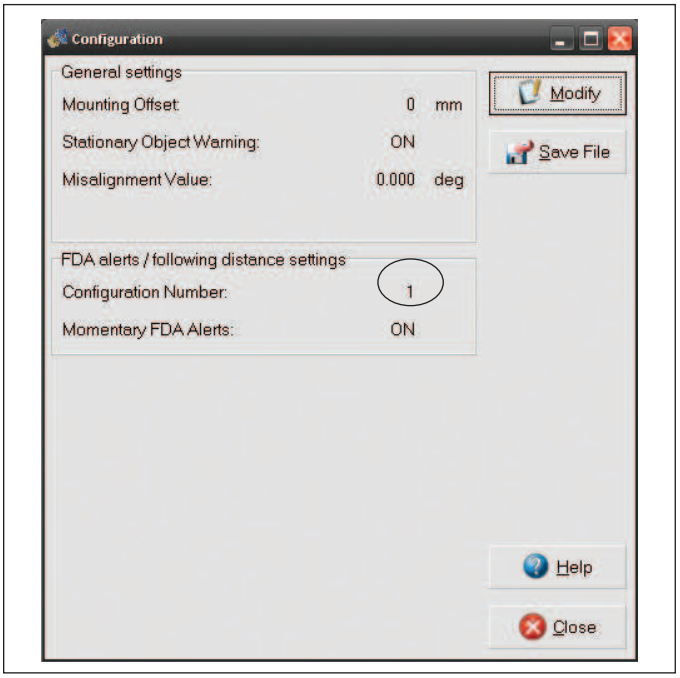


FIGURE 17 - *BENDIX® ACOM® SCREEN SHOWING CONFIGURATION NUMBER*

5.2 BENDIX WINGMAN ADVANCED DIAGNOSTIC TROUBLE CODE (DTC) SELF-CLEARING

Many of the diagnostic trouble codes (DTCs) will automatically clear when the cause of the problem is corrected. When the technician troubleshoots a diagnostic trouble code, it is recommended that a current version of the Bendix ACom Diagnostics software be used to clear the diagnostic trouble codes as directed by the repair procedure.

Some codes will clear immediately and the functionality will resume. Some codes will clear after powering off the ignition for about 15 seconds and then turning it back on. Other codes will clear after the engine runs for about 15 seconds.

If the vehicle’s cruise control can be engaged, that indicates all Wingman Advanced trouble codes have been cleared.

5.3 FOLLOWING DISTANCE ADJUSTMENT SWITCH (OPTIONAL)

If the vehicle is equipped with the following distance adjustment switch and the following distance does not change after an adjustment is made, the switch, wiring, or a controller on the vehicle should be checked using the diagnostic procedures described by the vehicle manufacturer. The radar sensor receives the driver’s desired following distance on the J1939 data communication link from a controller on the vehicle. No diagnostic trouble code will be set if the vehicle is not equipped with a following distance adjustment switch.

5.4 CONFIGURING BENDIX® WINGMAN® ADVANCED™ FOLLOWING DISTANCE ALERTS

Multiple alert and distance setting strategies, known as Following Distance Alert (FDA) configurations, can be chosen using the Bendix® ACom® Diagnostics tool. In current versions of ACom software, the service technician will find a selection box called "Configuration Number" which gives the service technician the choices shown in Figure 18 and in Table 8.

See Appendix B for an example of following distance alerts for systems where a Bendix® Driver Interface Unit (DIU) is used. See Appendix F for information about how to change the FDA settings and enable momentary beeping.

Configuring Wingman® Advanced™ Following Distance Alerts (5.4)					
Configuration No.	Option	Farthest Following Distance	Medium Following Distance	Closest Following Distance	Default Advanced Following Distance (seconds)
		Slow Audible Alert (sec.)	Medium Speed Audible Alert (sec.)	Fast Audible Alert (sec.)	
11	City	—	—	0.5	2.8
	Highway (>37 mph)	1.5	1.0	0.5	
2	City	—	—	0.5	3.5
	Highway (>37 mph)	1.5	1.0	0.5	
3	City	—	1.5	1.0	2.8
	Highway (>37 mph)	2.0	1.5	1.0	
4	City	—	1.5	1.0	3.5
	Highway (>37 mph)	2.0	1.5	1.0	
5	City	—	1.5	1.0	3.5
	Highway (>37 mph)	3.0	2.0	1.0	
6	City	3.0	1.5	1.0	3.5
	Highway (>37 mph)	3.0	2.0	1.0	
7	City	—	—	0.2	2.8
	Highway (>37 mph)	—	—	0.2	
8 *See Note Below*	City	—	—	0.5	1.7
	Highway (>37 mph)	1.5	1.0	0.5	
9 *See Note Below*	City	—	—	0.5	2.3
	Highway (>37 mph)	1.5	1.0	0.5	

TABLE 8 - ***CONFIGURING FOLLOWING DISTANCE ALERTS (FDA).***

Note: Configurations 8 and 9 are available on select applications only and may not be available on your system.

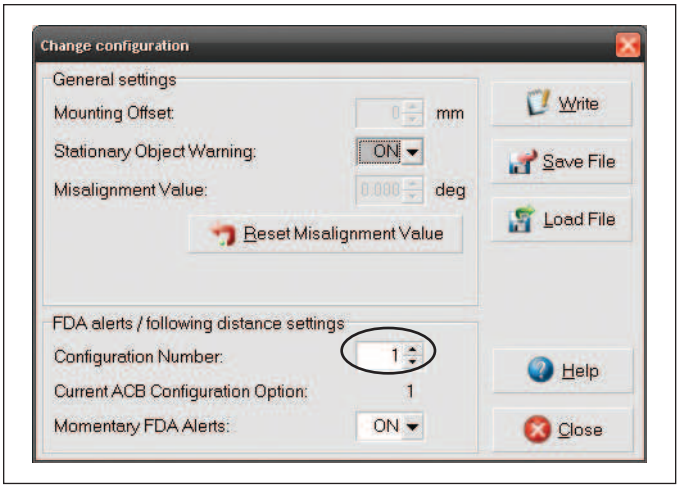


FIGURE 18 - *BENDIX® ACOM® DIAGNOSTICS – CONFIGURATION NUMBER (SHOWING CONFIGURATION ONE SELECTED). SEE ALSO TABLE 8.*

Changing configuration allows the fleet user to adjust both the following distance alerts and the following distance behind a detected forward vehicle. *See Figure 18.*

5.5 EXTRACTING BENDIX® WINGMAN® ADVANCED™ SYSTEM DATA

5.5.1 DATA AVAILABILITY

Data will not be stored by the system until the "Clear Resettable Data Log" (*see Figure 19*) is selected and the proper Bendix® ACom® Diagnostics license key is present. Contact Bendix at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for the ACom Diagnostics software license key and the set-up procedure.

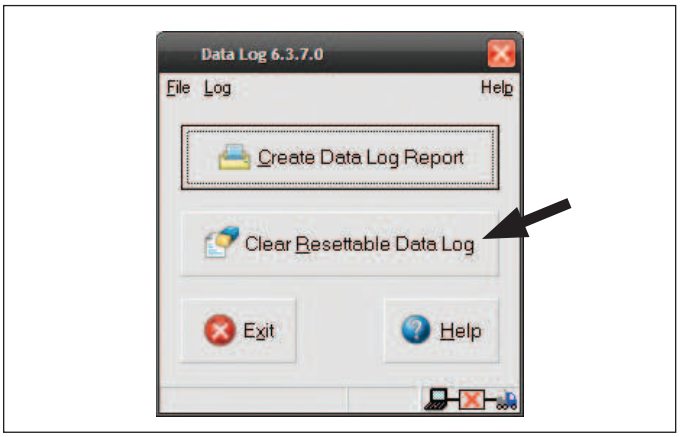


FIGURE 19 - *CLEARING THE RESETTABLE DATA LOG*

5.5.2 DATA OVERVIEW

At the fleet's discretion, Wingman Advanced makes data available (*see Figure 22*), in a data log, regardless of whether or not Advanced is used. The log can be reset using the Bendix ACom Diagnostics software as often as needed.

5.5.3 EXTRACTING DATA AND SAVING A REPORT

The ACom Diagnostics tool and User Guide is available online at "ABS Software" link under "Services and Support" on the Bendix website (www.bendix.com). Use the User Guide for specific instructions on extracting data from the Wingman Advanced system.

After a successful connection, the service technician will be presented with the window shown in Figure 20.

Select "Start ACB Data Log". The service technician will be asked to enter the vehicle ID and mileage. This data will be stored in the report. *See Figure 20.*

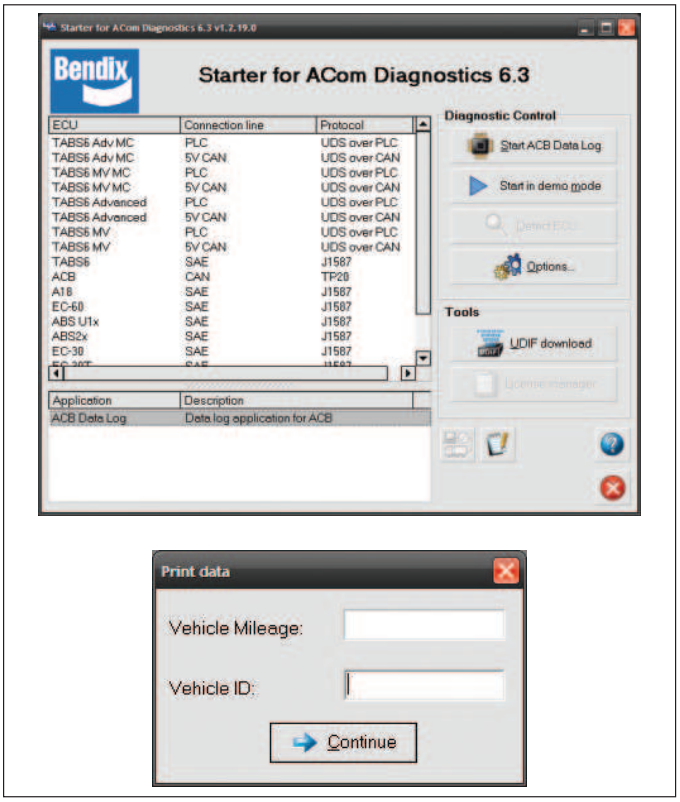


FIGURE 20 - *VEHICLE DATA*

The service technician can choose whether to "Print", "Print Preview", "E-mail", or "Save" the report to disk. *See Figure 21.* The data can be saved as a comma delimited file or an HTML web page file.

See Figure 22 on next page for a sample report.

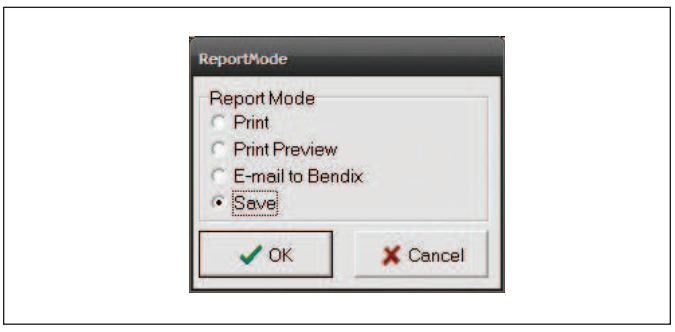
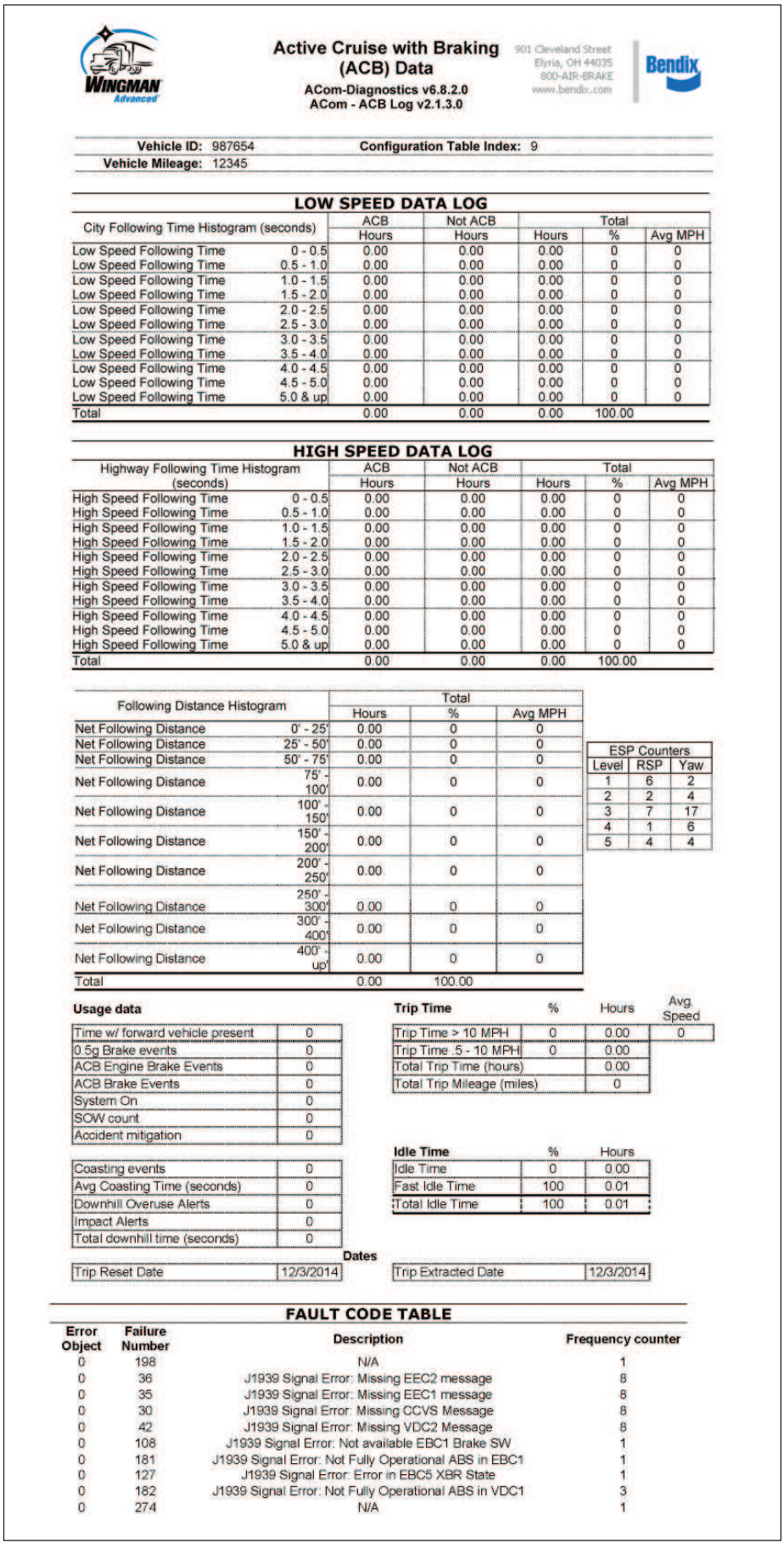


FIGURE 21 - *REPORT MODE*



Active Cruise with Braking (ACB) Data

ACom-Diagnostics v6.8.2.0
ACom - ACB Log v2.1.3.0

901 Cleveland Street
Elyria, OH 44035
800-AIR-BRAKE
www.bendix.com

Vehicle ID: 987654 **Configuration Table Index:** 9
Vehicle Mileage: 12345

LOW SPEED DATA LOG

City Following Time Histogram (seconds)		ACB Hours	Not ACB Hours	Total Hours	Total %	Total Avg MPH
Low Speed Following Time	0 - 0.5	0.00	0.00	0.00	0	0
Low Speed Following Time	0.5 - 1.0	0.00	0.00	0.00	0	0
Low Speed Following Time	1.0 - 1.5	0.00	0.00	0.00	0	0
Low Speed Following Time	1.5 - 2.0	0.00	0.00	0.00	0	0
Low Speed Following Time	2.0 - 2.5	0.00	0.00	0.00	0	0
Low Speed Following Time	2.5 - 3.0	0.00	0.00	0.00	0	0
Low Speed Following Time	3.0 - 3.5	0.00	0.00	0.00	0	0
Low Speed Following Time	3.5 - 4.0	0.00	0.00	0.00	0	0
Low Speed Following Time	4.0 - 4.5	0.00	0.00	0.00	0	0
Low Speed Following Time	4.5 - 5.0	0.00	0.00	0.00	0	0
Low Speed Following Time	5.0 & up	0.00	0.00	0.00	0	0
Total		0.00	0.00	0.00	100.00	

HIGH SPEED DATA LOG

Highway Following Time Histogram (seconds)		ACB Hours	Not ACB Hours	Total Hours	Total %	Total Avg MPH
High Speed Following Time	0 - 0.5	0.00	0.00	0.00	0	0
High Speed Following Time	0.5 - 1.0	0.00	0.00	0.00	0	0
High Speed Following Time	1.0 - 1.5	0.00	0.00	0.00	0	0
High Speed Following Time	1.5 - 2.0	0.00	0.00	0.00	0	0
High Speed Following Time	2.0 - 2.5	0.00	0.00	0.00	0	0
High Speed Following Time	2.5 - 3.0	0.00	0.00	0.00	0	0
High Speed Following Time	3.0 - 3.5	0.00	0.00	0.00	0	0
High Speed Following Time	3.5 - 4.0	0.00	0.00	0.00	0	0
High Speed Following Time	4.0 - 4.5	0.00	0.00	0.00	0	0
High Speed Following Time	4.5 - 5.0	0.00	0.00	0.00	0	0
High Speed Following Time	5.0 & up	0.00	0.00	0.00	0	0
Total		0.00	0.00	0.00	100.00	

Following Distance Histogram		Total Hours	Total %	Total Avg MPH
Net Following Distance	0' - 25'	0.00	0	0
Net Following Distance	25' - 50'	0.00	0	0
Net Following Distance	50' - 75'	0.00	0	0
Net Following Distance	75' - 100'	0.00	0	0
Net Following Distance	100' - 150'	0.00	0	0
Net Following Distance	150' - 200'	0.00	0	0
Net Following Distance	200' - 250'	0.00	0	0
Net Following Distance	250' - 300'	0.00	0	0
Net Following Distance	300' - 400'	0.00	0	0
Net Following Distance	400' - up'	0.00	0	0
Total		0.00	100.00	

ESP Counters		
Level	RSP	Yaw
1	6	2
2	2	4
3	7	17
4	1	6
5	4	4

Usage data

Time w/ forward vehicle present	0
0.5g Brake events	0
ACB Engine Brake Events	0
ACB Brake Events	0
System On	0
SOW count	0
Accident mitigation	0
Coasting events	0
Avg Coasting Time (seconds)	0
Downhill Overuse Alerts	0
Impact Alerts	0
Total downhill time (seconds)	0

Trip Time

	%	Hours	Avg. Speed
Trip Time > 10 MPH	0	0.00	0
Trip Time .5 - 10 MPH	0	0.00	
Total Trip Time (hours)		0.00	
Total Trip Mileage (miles)		0	

Idle Time

	%	Hours
Idle Time	0	0.00
Fast Idle Time	100	0.01
Total Idle Time	100	0.01

Dates

Trip Reset Date	12/3/2014
Trip Extracted Date	12/3/2014

FAULT CODE TABLE

Error Object	Failure Number	Description	Frequency counter
0	198	N/A	1
0	36	J1939 Signal Error: Missing EEC2 message	8
0	35	J1939 Signal Error: Missing EEC1 message	8
0	30	J1939 Signal Error: Missing CCVS Message	8
0	42	J1939 Signal Error: Missing VDC2 Message	8
0	108	J1939 Signal Error: Not available EBC1 Brake SW	1
0	181	J1939 Signal Error: Not Fully Operational ABS in EBC1	1
0	127	J1939 Signal Error: Error in EBC5 XBR State	1
0	182	J1939 Signal Error: Not Fully Operational ABS in VDC1	3
0	274	N/A	1

FIGURE 22 - ***TYPICAL WINGMAN ADVANCED VEHICLE REPORT***

6.0 BENDIX® WINGMAN® ADVANCED™ RADAR SENSOR MOUNTING AND INSTALLATION SECTION

Note: This section only covers Bendix-supplied mounting arrangements. *(See Figure 23 for Bendix-supplied mounting arrangement. At time of printing, Bendix-supported mounting arrangements are used on Mack® and Volvo® trucks).* For other mounting arrangements consult the OEM.

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6.2 Radar Sensor Mounting 29
6.3 Replacement Parts 29
6.4 Radar Sensor Alignment 30
6.5 Cover Removal 30
6.6 Bendix® Alignment Tool 30
6.7 Check Vertical Alignment 30
6.8 Vertical Adjustment Procedure 32
6.9 Check Lateral Alignment 32
6.10 Lateral Adjustment Procedure 33
6.11 Reset Lateral Alignment Value 33
6.12 Reinstall The Plastic Cover 33

6.1 VEHICLE APPLICATIONS

The radar sensor can be mounted and installed only on vehicles that have Wingman Advanced already installed. At this time Wingman Advanced can not be retrofitted onto vehicles, even if that vehicle is equipped with the Bendix® ESP® stability system.

6.2 RADAR SENSOR MOUNTING

When mounting a radar sensor, the wire harness connector should always point down. The radar sensor assembly is mounted to the front of the vehicle using an adjustable bracket. This adjustable bracket allows for the radar sensor to be properly aimed laterally and vertically to maximize Wingman Advanced system performance.

The assembly should always be mounted in the *Original Equipment Manufacturer (OEM)* location. If this location is not in the center of the vehicle, the mounting offset will need to be programmed through Bendix® ACom® Diagnostics software; *see Section 6.9: Check Lateral Alignment*.

For proper operation of your Wingman Advanced system, adhere to the following guidelines:

- The radar sensor assembly should be rigidly installed on the vehicle following all OEM recommended torque specifications.
- The radar sensor assembly should be installed in the original OEM designated location.
- The radar sensor cover should always be installed. This helps protect components such as the connector and wiring harness from road debris.
- The radar sensor assembly must be oriented so that the electrical connector points down. **Mounting the radar upside down will impair performance significantly.**
- The radar's field of view must NOT have interference from any other vehicle components such as bumpers, cow-catcher bumpers, engine blankets, seasonal decorations, or any other commonly mounted front-of-vehicle components. ***See Appendix E.***

NOTE: If the radar sensor was originally installed behind a panel, check the panel for damage, etc. that may impact the radar's performance before reinstalling. Replace the panel, if necessary, with an original OEM supplied panel. ***Do not paint over the panel.***

6.3 REPLACEMENT PARTS

Replacement parts exist for all components shown in Figure 23. Parts are available from any Bendix authorized parts supplier.

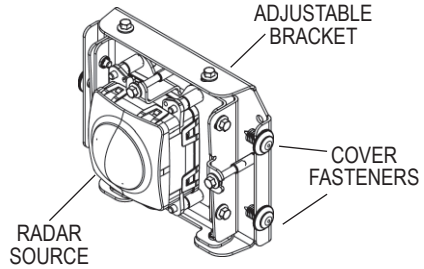
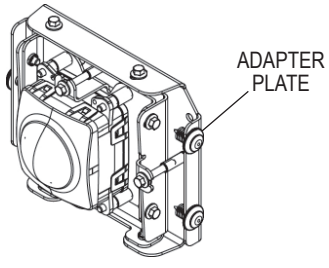
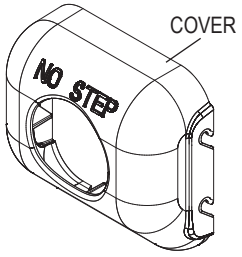
		
Typical Radar Sensor Assembly	**Typical Advanced Assembly with Adapter Plate**	**Advanced Cover**
• Advanced Radar sensor (or Advanced Radar Sensor) • Adjustable Bracket • Cover Fasteners – Plastic Tree Style	• Radar • Adjustable Bracket • Adapter Plate • Cover Fasteners – Plastic Tree Style	• Cover Fasteners – Plastic Tree Style (Note: cover may vary depending on OEM installation)

FIGURE 23 - ***TYPICAL ADVANCED ASSEMBLIES AND COVER WITH SERVICE REPLACEMENT PARTS***

6.4 RADAR SENSOR ALIGNMENT

Accurate vertical and lateral alignment of the radar sensor is critical for proper operation of Bendix® Wingman® Advanced™. Improper alignment will cause false warnings, missed warnings and a diagnostic trouble code in the system.

The radar sensor is mounted to the front of the vehicle using an adjustable bracket. Use the following procedures to align the radar sensor in its adjustable bracket:

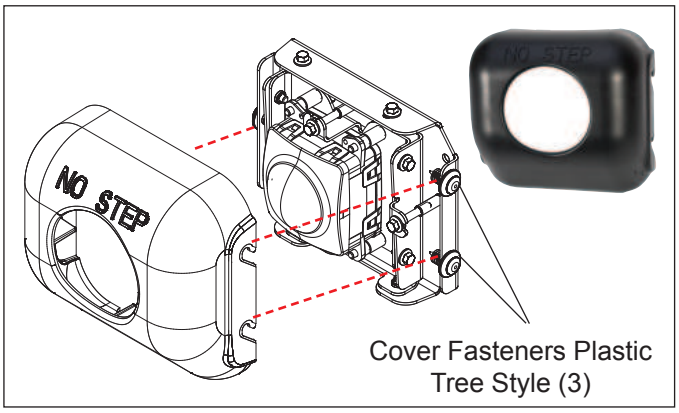


FIGURE 24 - *COVER AND PLACEMENT OVER RADAR SENSOR ASSEMBLY*

6.5 COVER REMOVAL

To remove the cover, use a slight force to pull the cover up and away from the bracket. The three cover fasteners do not need to be removed. *See Figures 24 and 25.*

FIGURE 25 - *COVER REMOVAL*

6.6 BENDIX® ALIGNMENT TOOLS

The Bendix® Alignment Tools (Bendix part nos: K065284, K041451, K096579, or K041227) - available from Bendix parts outlets - are used to align the radar sensor both vertically and laterally. They fasten magnetically to the radar sensor assembly for easy placement and removal. *See Figures 26-28.*

6.7 CHECK THE RADAR SENSOR VERTICAL ALIGNMENT

See Section 6.6 for the Bendix® Alignment Tools available. Additionally, Bendix strongly recommends that a digital inclinometer should be when checking the vertical alignment of the radar sensor.

6.7.1 Remove the cover as shown in *Section 6.5: Cover Removal*.

6.7.2 If the vehicle has an air suspension system, charge the system and set it to “level” prior to carrying out an radar sensor check or alignment procedure. If the system is not charged, the vertical alignment will be off and the Wingman Advanced system will not perform correctly.

6.7.3 For an accurate check (and adjustment, if necessary) of the vertical alignment, the vehicle needs to be parked on a flat, level surface.

NOTE: If the service technician is unable to park the vehicle on a level floor, a digital inclinometer must be used to align the sensor vertically.

6.7.4. Position the alignment tool over the sensor so that it straddles the sensor. Attach the alignment tool to the bracket/sensor assembly using its magnet attachments. Use the Lateral Alignment level to make sure that the alignment tool is approximately horizontal width-wise. *See Figures 27 and 28.*

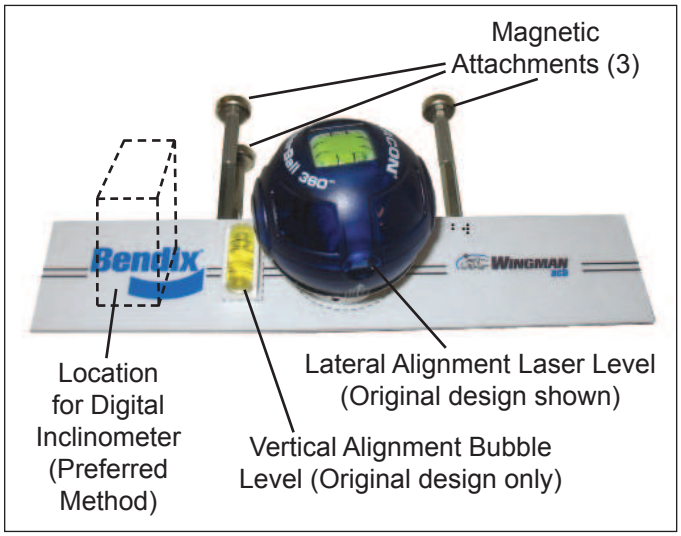

Magnetic Attachments (3)
Location for Digital Inclinometer (Preferred Method)
Lateral Alignment Laser Level (Original design shown)
Vertical Alignment Bubble Level (Original design only)

FIGURE 26 - *BENDIX® ALIGNMENT TOOL (K041451 OR K041227)*

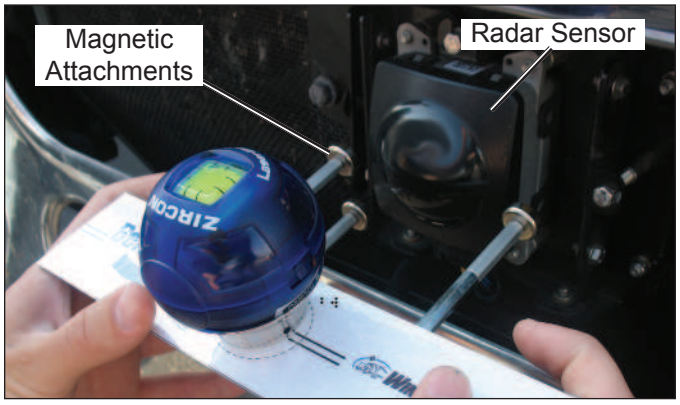


FIGURE 27 - *ATTACHING THE ALIGNMENT TOOL (SHOWS TOOL K041451 OR K041227)*

6.7.5 **Check the vertical alignment**.

Using the standard tool K065284. With the air suspension charged and set to "level", calibrate ("zero") the inclinometer on a horizontal section of the frame rail. Follow the manufacturer's instructions (typically digital inclinometers have a "SET" button for this purpose).

Check the alignment with the alignment tool in position so that it straddles the radar sensor. **Verify that the radar is aligned downward**, towards the road surface in front of the vehicle, **by -1.3°** (±0.8°), when measured by an inclinometer set to zero on the vehicle's frame. If the sensor is not aligned correctly, follow the instructions in section 6.8.

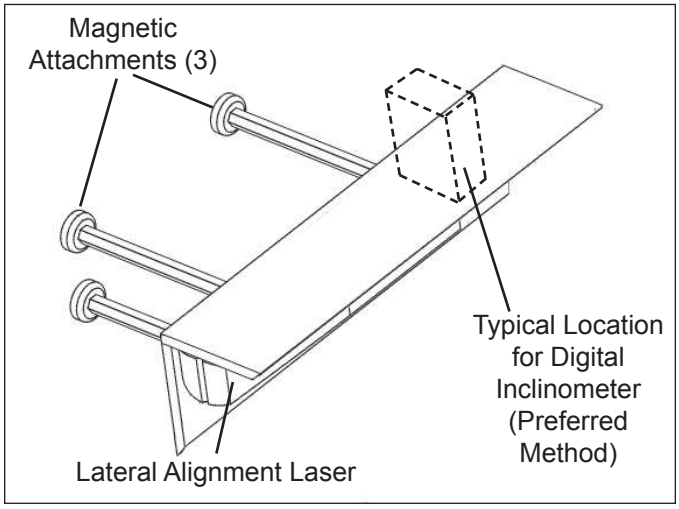


FIGURE 28 - *VERTICAL ALIGNMENT TOOL (K065284 - SHOWN - OR K096579 - SIMILAR WITH SHORTER WIDTH)*

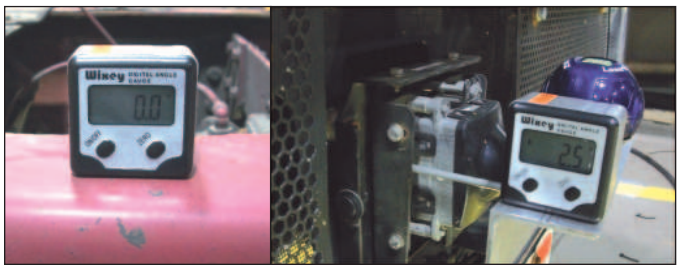


FIGURE 29 - *INCLINOMETER*

6.7.6 **If you have the original design of alignment tool K041451 or K041227** *(See Figure 26)*:

Where a digital inclinometer is available — or if a flat, level location is not available (in which case a digital inclinometer **must** be used) — do not use the bubble level.

Verify that the radar is aligned downward, towards the road surface in front of the vehicle, **by -1.3°** (±0.8°), when measured by an inclinometer set to zero on the vehicle's frame.

Where the bubble-level may be used, verify that the bubble just touches the line nearest the vehicle. This shows that an incline of approximately one half of a degree downward has been set. *See Figure 31*.

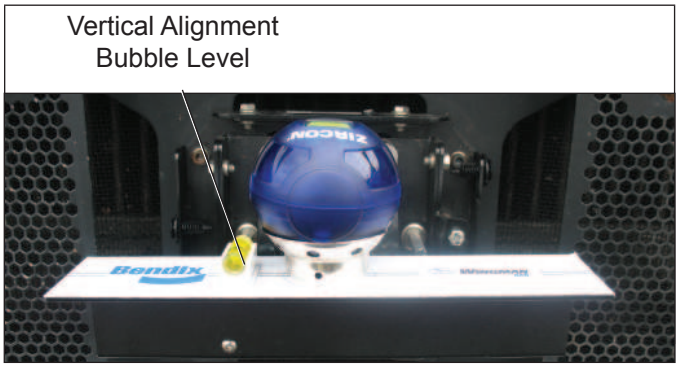


FIGURE 30 - *VERTICAL ALIGNMENT BUBBLE LEVEL*

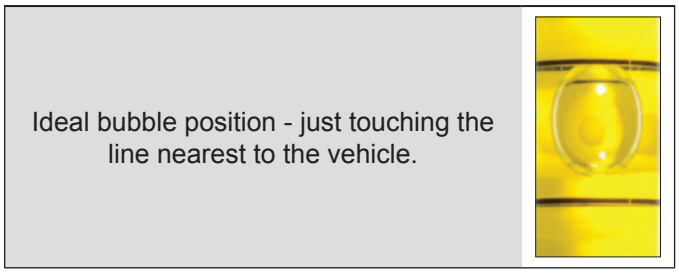


FIGURE 31 - *USING THE BUBBLE POSITION TO CHECK THE VERTICAL ALIGNMENT (VEHICLE ON LEVEL GROUND)*

If the sensor is not aligned correctly, follow the instructions in section 6..8

6.8 RADAR SENSOR VERTICAL ALIGNMENT ADJUSTMENT PROCEDURE

NOTE: Complete these steps only if a vertical adjustment is necessary.

Tools needed:

7 mm box wrench and Bendix® alignment tool.

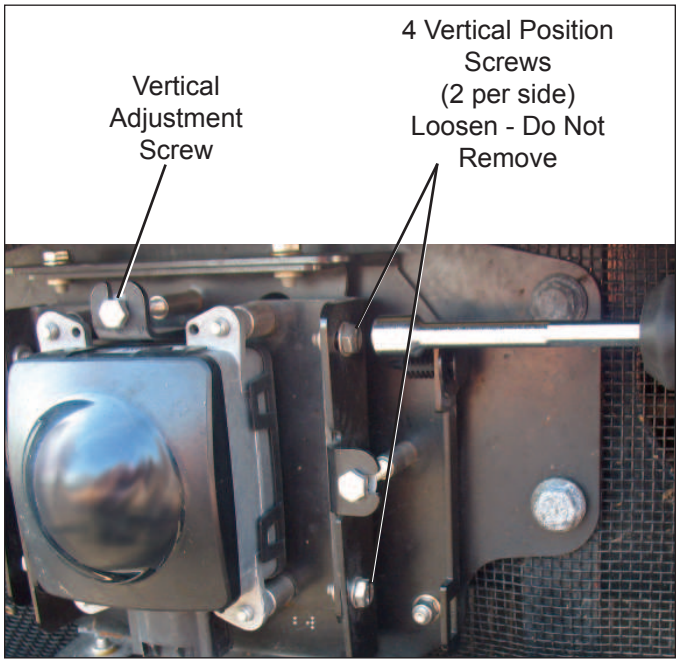


FIGURE 32 - *VERTICAL ADJUSTMENT (NOTE THIS IMAGE DOES NOT SHOW THE ALIGNMENT TOOL INSTALLED)*

1. Be sure the vehicle is prepared as shown in Sections 6.7.1-3.
2. With the Bendix alignment tool still in place, loosen the four vertical position screws. DO NOT remove these screws. *See Figure 31.* During the adjustment, turn the vertical alignment screw clockwise or counterclockwise depending on the vertical direction (up or down) needed. Clockwise aligns the radar sensor up and counterclockwise moves the radar sensor down.
3. **Where the original tool is being used: (kits K041451 or K041227)**

   In cases where a digital inclinometer is not being used, the adjustment should be made until the bubble is just touching the line closest to the vehicle (*See Figure 31.*)
4. **Where a digital inclinometer is being used:**

   Adjust the vertical adjustment screw until the digital inclinometer shows that **the radar is aligned downward**, towards the road surface in front of the vehicle, **by -1.3°** (±0.8°), when measured by an inclinometer set to zero on the vehicle's frame. (*See Figure 29.*)
5. Re-tighten the four vertical position screws to hold desired alignment in place.
6. Re-check the vertical alignment after tightening the four vertical position screws.

Note: The alignment process shown here is for Bendix alignment brackets. For other brackets, similar alignment steps will be needed; consult the vehicle manual for full instructions.

6.9 CHECK THE RADAR SENSOR LATERAL ALIGNMENT

See Section 6.6 for available Bendix® Alignment Tools.

Tools needed: 7 mm box wrench, Bendix® alignment tool and a tape measure.

1. Park the vehicle on a flat, level surface. The vertical alignment must be checked and adjusted, if needed, before the lateral adjustment can be made.
2. Remove the cover as shown previously in Section 6.5: *Cover Removal*.
3. Position the alignment tool over the radar sensor so that it straddles the radar sensor. Attach the alignment tool to the bracket / radar sensor assembly with its magnet attachments. *See Figures 33 and 34.*
4. Activate the lateral alignment laser light "on" switch.

   For kits K041451 or K041227, position and place it in its cradle, making sure it is sitting level, and align the laser beam between the reference lines on the Bendix alignment tool left or right. *See Figure 32.*

   For kits K065284 and K096579, place the tool into position for the first measurement. (The tool will be reversed when the second measurement is made.)
5. Using a ruler or tape measure, measure the distance from a symmetrical vehicle point (such as the tow hooks) to the laser light line. Record this measurement. *See Figure 35.*

   NOTE: *The technician must be extremely careful during the laser positioning process to double-check the values measured on each side of the truck. Be sure to check back and forth for each side of the radar sensor several times to ensure accuracy.*
6. Repeat the same process for the opposite side and measure the reference distance to the laser line. For tool K042452, the blue laser level is rotated 180 degrees, and for tools K065284 and K096579, the whole tool is reversed so that the laser light points to the other side of the vehicle.
7. Compare the left and right distance measurements. A properly aligned radar sensor will have the same measurement from side to side. If these two dimensions are within 1/8" (3 mm), no alignment is necessary. If not, follow the instructions in Section 6.10: *Lateral Adjustment Procedure*.

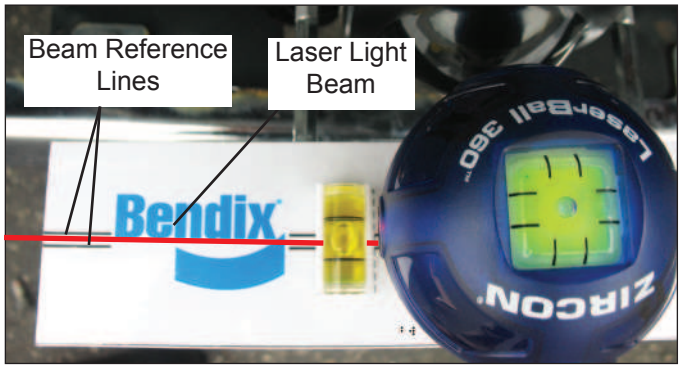


FIGURE 33 - *POSITIONING THE LASER LEVEL (KITS K041451 OR K041227)*

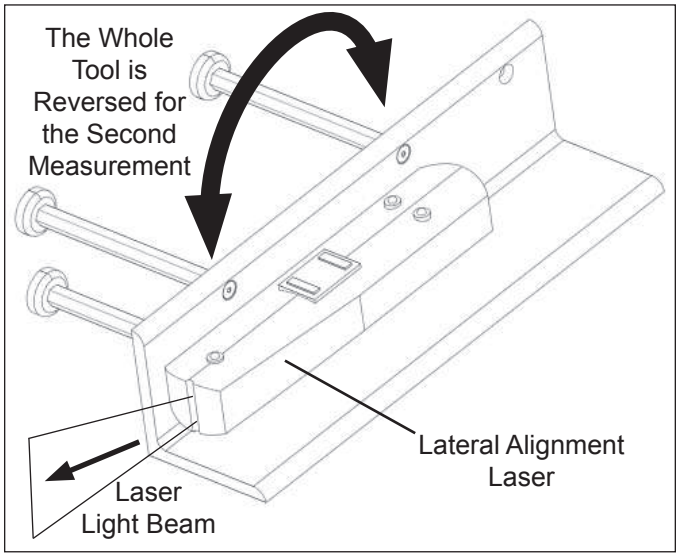


FIGURE 34 - *USING THE LATERAL ALIGNMENT LEVEL (KIT K065284)*

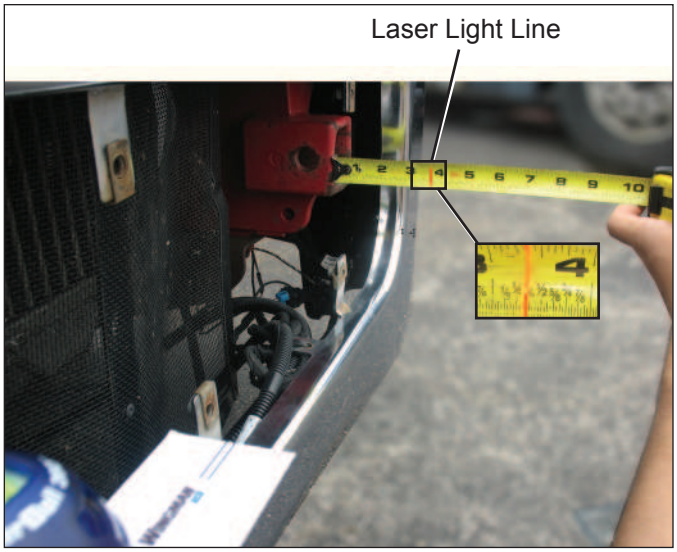


FIGURE 35 - *LATERAL ALIGNMENT VERIFICATION*

NOTE: *The lateral alignment also can be checked with a current version of Bendix ACom® Diagnostics. A value between -0.8° and 0.8° is acceptable and the system should operate normally. A value between -0.8° to -1.3° OR 0.8° to 1.3° means the radar sensor is misaligned and system performance will be degraded. The service technician should align the radar sensor using the procedures noted in this section.*

If the value is less than (<) -1.3°, or greater than (>) 1.3°, the system will typically issue a Diagnostic Trouble Code. The service technician should align the radar sensor laterally. A positive value means the radar sensor should be aligned toward the driver side. A negative value means the radar sensor should be aligned towards the passenger side. The vehicle must be driven at least 20 miles between adjustments. *See "Alignment Value" in Figure 17.*

6.10 LATERAL ADJUSTMENT PROCEDURE

NOTE: Complete these steps only if a vertical adjustment is necessary.

1. Loosen the four lateral position screws. DO NOT fully remove them. *See Figure 36.*

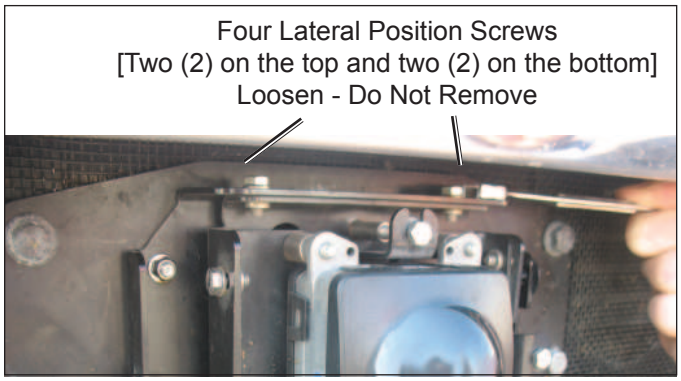


FIGURE 36 - *LATERAL POSITION SCREWS*

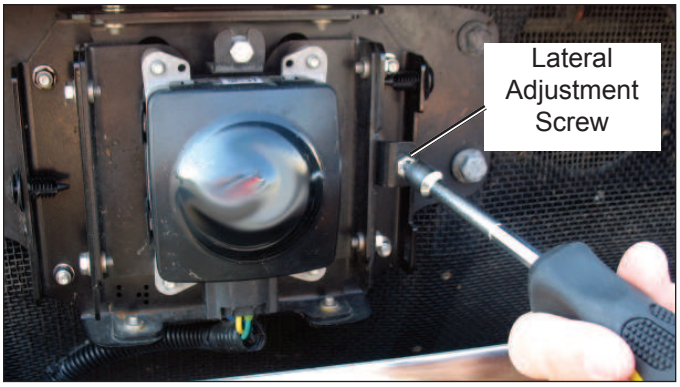


FIGURE 37 - *LATERAL ADJUSTMENT*

2. *See Figure 37.* Adjust the lateral adjustment screw until the desired alignment is reached. DO NOT remove the screws. Use steps 4 through 7 in Section 6.9: *Check Lateral Alignment* section to measure.
3. Retighten the four lateral position screws to hold the desired alignment in place.
4. Recheck the lateral alignment as described above.
5. After the lateral alignment procedure is complete, if there is an active misalignment DTC (codes 55, 56, or 57), reset the alignment value using the procedure in Section 6.11.

6.11 RESET LATERAL ALIGNMENT VALUE IN BENDIX® ACOM® DIAGNOSTICS

If a "radar alignment" diagnostic trouble code (DTC) was logged, after repairs, the vehicle will need to be connected to a PC with ACom Diagnostics software to reset the "Alignment Value" to zero.

1. In ACom Diagnostics select Wingman Advanced on the starter screen, and then select "Start with ECU."
2. Select "Config" on the Wingman Advanced Status window.
3. Select "Modify" on the Configuration Status window.
4. Select "Reset Alignment Value" in the Change Configuration box.
5. Select "Write" button in the dialogue box.
6. Clear the Bendix® Wingman® Advanced™ system trouble code using the procedure in Section 4.4: *Clearing Diagnostic Trouble Codes (DTCs)*. *Also, see Appendix D.*
7. Close the ACom Diagnostics program and any open windows.
8. Cycle the vehicle ignition.

6.12 REINSTALL THE PLASTIC COVER

With a slight force, push the cover onto the bracket so that the plastic fasteners line up with the slots on the plastic cover. Ensure the cover is secure over the radar sensor assembly before driving the vehicle.

APPENDIX A - TROUBLESHOOTING CHECKLIST

Appendix A	
Troubleshooting Checklist	
Detailed Scenarios and Tests	**Record Driver's Answers for Follow-up with Bendix**
Does the vehicle maintain its set speed when cruise control is switched on and set?	Yes ☐ No ☐ _____
Is the cruise control "set" icon displayed?	Yes ☐ No ☐ _____
While following a forward vehicle within radar range and the cruise control switched on and set, observe the following:	
Is the forward vehicle detected icon displayed?	Yes ☐ No ☐ _____
What color is the icon?	Icon Color_____
When the forward vehicle slows down, does the truck also slow down to maintain the set distance?	Yes ☐ No ☐ _____
With engine cruise "off" and a forward vehicle present, does the audible alert become faster as the truck moves closer to the forward vehicle?	Yes ☐ No ☐ _____
With cruise control switched on and set, when the forward vehicle slows moderately or cuts in front of the truck and slows, did you observe any of the following conditions?	
Does the vehicle slow and Advanced maintain the following distance?	Yes ☐ No ☐ _____
Is the engine throttle reduced?	Yes ☐ No ☐ _____
Is the engine retarder applied?	Yes ☐ No ☐ _____
Are foundation brakes applied?	Yes ☐ No ☐ _____
Are there diagnostic trouble codes logged?	Yes ☐ No ☐ _____
Does the truck proceed toward the forward vehicle without a following distance alert or braking intervention?	Yes ☐ No ☐ _____
With cruise control engaged, and while following a vehicle ahead in gentle curves (assuming a 3 to 3.5 second following distance):	
Does Advanced continue to follow the vehicle through the curves following at a constant distance?	Yes ☐ No ☐ _____
Does the truck proceed toward the forward vehicle without a following distance alert or braking intervention?	Yes ☐ No ☐ _____
With cruise engaged, when your vehicle passes a slower vehicle on left or right on a straight or slightly curvy road:	
Does Advanced ignore the vehicle you are overtaking?	Yes ☐ No ☐ _____
Does it give a following distance alert?	Yes ☐ No ☐ _____

Appendix A	
Troubleshooting Checklist	
Detailed Scenarios and Tests	**Record Driver's Answers for Follow-up with Bendix**
With cruise engaged, and a faster vehicle passes your vehicle on the left or right on a straight or slightly curvy road:	
Does your vehicle throttle up and try to keep pace with the faster moving vehicle?	Yes ☐ No ☐ _____
Does it give a following distance alert?	Yes ☐ No ☐ _____
With cruise control engaged, if the vehicle ahead slows moderately or cuts in front of your truck and slows down:	
Does your vehicle slow and Advanced maintain the following distance?	Yes ☐ No ☐ _____
Is the engine throttle reduced?	Yes ☐ No ☐ _____
Is the engine retarder applied?	Yes ☐ No ☐ _____
Are the foundation brakes applied?	Yes ☐ No ☐ _____
Are there diagnostic trouble codes logged?	Yes ☐ No ☐ _____
Does your truck proceed toward the forward vehicle without a following distance alert or braking intervention?	Yes ☐ No ☐ _____
What version of Bendix® ABS and Bendix® Wingman® Advanced™ is installed on the vehicle? *See Section 4.21: Reading the Advanced Software Version.*	_____
What are the key system indicators? *See Section 5.1: System Key Indicators.*	_____ _____ _____ _____ _____
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, (Monday–Friday, 8:00 a.m. – 6:00 p.m. ET) for troubleshooting assistance.	

Appendix B

Driver Interface Unit: Displays & Alerts

B1 Operator Interface

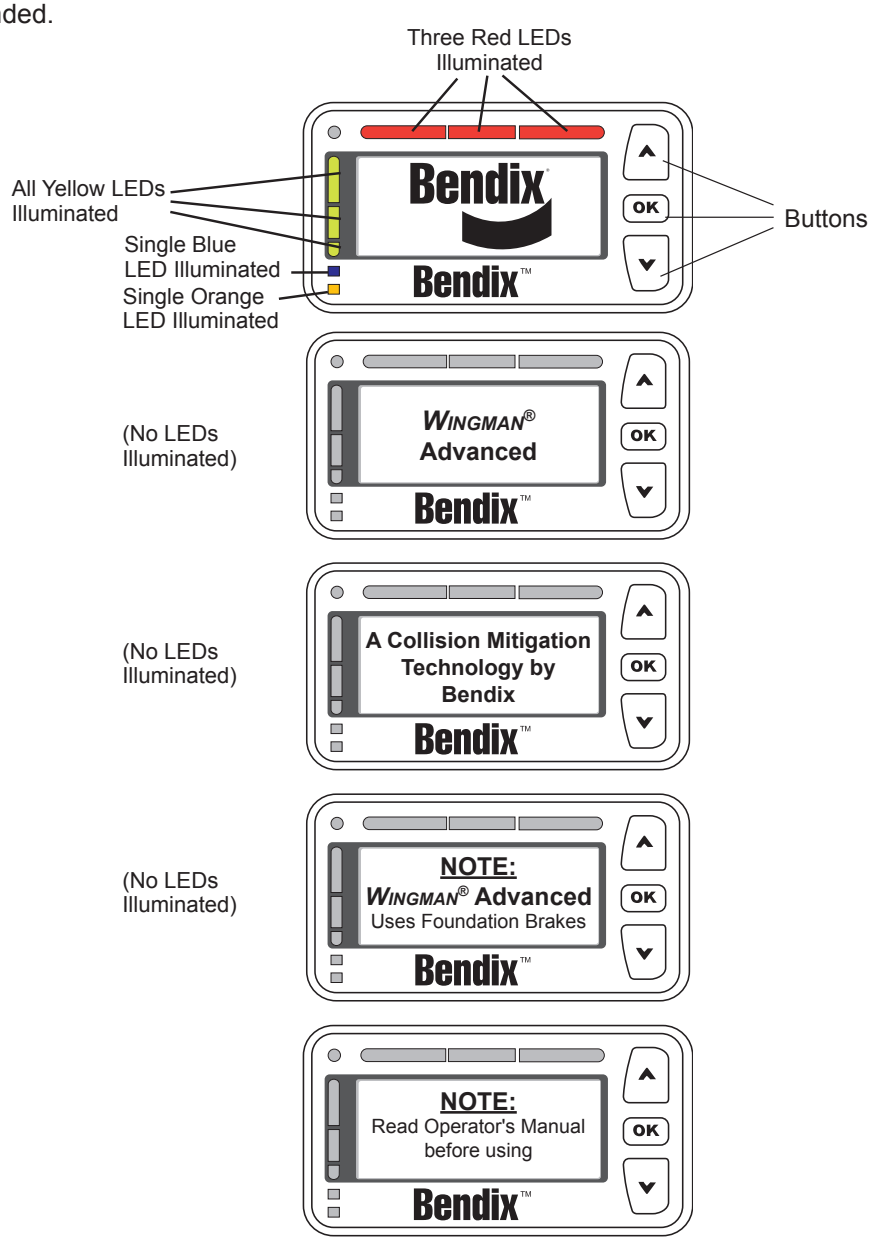
The Bendix® Wingman® Advanced™ system is either integrated into the vehicle's dash or console, or uses the Bendix® Driver Interface Unit (DIU) to communicate with the driver. *(For integrated systems, see the vehicle operator's manual for more information.)*

This Section describes the functions of the DIU. The DIU mounts in, or on, the vehicle dash and provides the interface between the driver and the Advanced system. The DIU provides visual and audio warnings to the driver and accepts input from the driver through the "Up", "Down" and "OK" buttons.

The DIU contains an internal speaker to provide audible warnings, 2 LED arrays (one each in yellow and red), a single orange and blue LED and an LCD screen for visual warnings, and a light radar sensor to distinguish between day and night conditions.

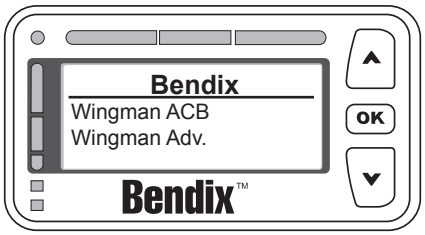
B1.1 Start-Up Mode

At initialization, the DIU executes self-test routines during which the following screens are displayed and all LEDs are activated (power-on bulb check) for approximately 3 seconds. If configured, a power-up tone is also sounded.



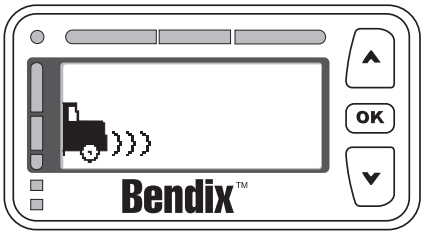
When the initialization sequence is complete, the following screen is displayed for approximately 3 seconds to indicate the features available to the driver.

(No LEDs Illuminated)



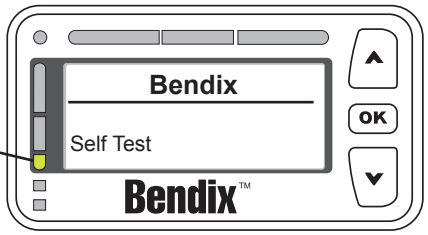
Next, the DIU will enter normal operation. Under normal operation, the screen is:

(No LEDs Illuminated)

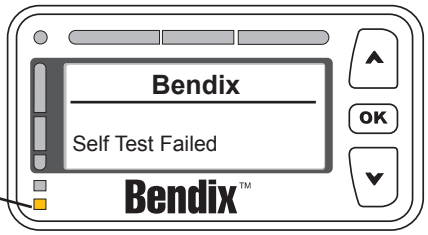


If the Bendix® Wingman® Advanced™ goes into self-test mode, the DIU may briefly display the "Bendix Self-Test" screen. Also, the audible distance alerts will activate, followed by a screen indicating that the self-test has run. Below left is the screen that will be briefly displayed if the self-test runs and passes. Below right is the screen that will be briefly displayed if the self-test runs and fails. If the self-test fails, a diagnostic trouble code (DTC) will be set. The driver should turn off the vehicle, wait 15 seconds and then turn it back on again. If the problem persists, a qualified technician will be necessary for troubleshooting. *See the "Power-Up Self-Test" in this service data sheet Section 3.1: Troubleshooting Basics for further information.*

Single Yellow LED Illuminated



(Followed by a Single Orange LED Illuminated)



B1.2 Menu Operation

Pressing the "OK" button at any time will enter the "Menu Operation Mode". The following selections will appear in a scrollable window. Some items may not appear if the feature is not configured or not allowed as shown below.

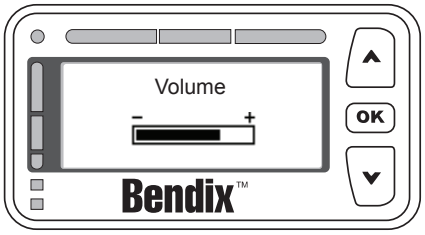
- Volume
- Dist. Setting (Distance Setting)
- Dist. Units (Distance Units)
- US/Metric
- Brightness
- System Status
- Diag. Display (Diagnostic Display)
- Demo (Demonstration. Note: Demo is available only when vehicle is not moving)

The desired menu item is highlighted using the up (▲) or down (▼) arrow buttons and selected with the "OK" button. The following sections describe each menu item.

B1.3 Volume

Selecting “Volume” from the main menu displays the following screen:

(No LEDs Illuminated)



The driver uses the up (▲)/down (▼) arrow buttons to change the volume. Pressing the “OK” button exits this menu item.

The modified volume setting will be retained through ignition cycles unless configured not to do so. If not configured, the volume setting will default to 100% on each new ignition cycle.

NOTE: The DIU can be configured to limit the minimum volume setting that the driver can select. The bar shown above always represents the adjustable range based on minimum and maximum values. For example, if the minimum value is set to 50% (midpoint between lowest (70 +/- 3dB) and highest (89 +/- 3dB) audio levels, the bar represents an adjustable range from 50% (approx. 80dB) to 100% (approx. 89dB). Once the minimum (or maximum) has been reached, a message will be shown indicating that further adjustment is not allowed (e.g. “Minimum volume reached”). The step change per button press is approximately 2dB.

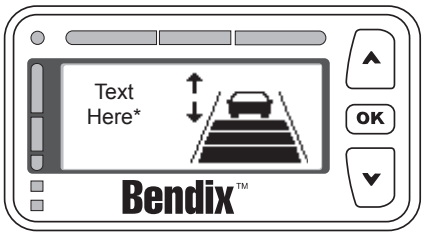
B1.4 Distance Setting (Dist. Setting)

On systems where changes are permitted, the “Distance Setting” option from the main menu will adjust the following distance that the Bendix® Wingman® Advanced™ system will attempt to maintain while in the following distance mode. Distance Settings 1, 2, 3, and 4 will have different meanings based on the configuration chosen by the user in Bendix® ACom® Diagnostics software. Generally, 4 relates to the farthest distance setting available and 1 relates to the closest distance setting available. In many of the Advanced configurations available in ACom®, two or more distance settings may be made equivalent to one another.

For more information on user configurations available through the Bendix ACom Diagnostics software, *see Section 5.4: Configuring Bendix Wingman Advanced Following Distance Alerts* in this Service Data sheet for further information.

Selecting “Dist. Setting” from the main menu displays the following screen:

(No LEDs Illuminated)



** Text may vary depending on the system installed*

B1.5 Distance Units (Dist. Units)

From the “Dist. Units” menu item, the user may choose to have the following distance from the forward vehicle displayed in either seconds or feet. By default, this item is set to seconds. If the user selects feet, the DIU will display the approximate distance from the bumper to the selected forward vehicle in feet. If the user selects seconds, the DIU will display the approximate distance from the bumper to the selected forward vehicle in seconds.

NOTE: Following distance in seconds is calculated based on the current speed of the Wingman® Advanced-equipped truck, and the distance, in feet, away from the selected forward vehicle. For instance, if the selected forward vehicle is 88 feet from the bumper of the Wingman Advanced-equipped truck, and the Wingman Advanced-equipped truck is traveling 60 mph, then the following distance in seconds would be 1.0 seconds because a truck traveling 60 mph can travel 88 feet in one (1) second.

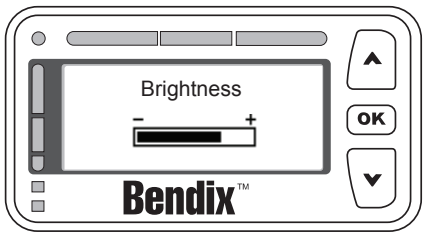
B1.6 US/Metric

From this menu item, the user may select whether English or Metric units are displayed. For instance in "metric" mode, the following distance is shown in meters. In "US" mode, the following distance is shown in feet.

B1.7 Brightness

Selecting Brightness from the main menu displays the following screen:

(No LEDs Illuminated)



The driver uses the up (▲)/down (▼) arrow buttons to change the LCD backlighting, LED brightness and button backlighting. Pressing the OK button exits this menu item.

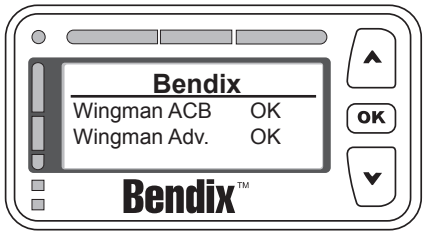
The light sensor reading determines whether the current cab lighting mode is bright (day) or dark (night). When the light mode is bright, any brightness adjustment made by the driver is applied to only the bright mode setting. Likewise, when the light radar sensor sets the light mode to dark, any brightness adjustment made by the driver is applied to only the dark mode setting. This functionality allows the driver to adjust the brightness setting for the two cab lighting conditions after which the DIU will automatically toggle between the two settings based on the light radar sensor's input. Both the bright mode setting and the dark mode setting are stored across power cycles.

NOTE: The DIU does not allow the brightness control to completely shut off the LEDs.

B1.8 System Status

This screen shows the configured features of the system and their current operational status (i.e., "Failed" or "OK"). The failed status means that some system malfunction is preventing the feature from properly operating and that the feature is not available for use by the driver at this time. Pressing "OK" exits this menu item.

(No LEDs Illuminated)



B1.9 Diagnostics

Selecting Diagnostics from the main menu displays any active Bendix® Wingman® Advanced™ Diagnostic Trouble Code (DTC) conditions [including SAE standard diagnostic codes called J1939 SPNs (Suspect Parameter Numbers) and J1939 FMIs (Failure Mode Identifiers)] that may be present in the DIU and radar sensor. The following is a typical screen displayed in this mode when an active DTC is present:

(No LEDs Illuminated)

B2.0 Driver Demonstration Mode

Selecting Demo from the main menu starts a demonstration mode that shows the various lights, display screens, and sounds produced by the DIU – along with a brief explanation of their meaning – for the configured features. Pressing the down (▼) arrow button advances through the screens. The up (▲) arrow button has no functionality in this mode. The mode may be exited at any time by pressing the OK button.

NOTE: This mode can only be entered while the vehicle is not moving. Also, while in the demonstration mode, if the vehicle begins to move, the demonstration mode terminates.

If a screen is associated only with a configurable feature, and that feature is not configured, then that screen will not be shown in the demonstration mode.

The screens presented to the driver in the demonstration mode are shown with the following text: "Error! Reference source not found."

B3.0 Following Distance Alerts (FDAs)

One of the features of the Bendix® Wingman® Advanced™ system is the Following Distance Alert (FDA). A proprietary system combining vehicle speed, forward vehicle speed, distance, and driving scenario, FDAs are used to provide the driver with distance alerts which are intelligent, in that they will give appropriate distance alerts for the given situation. They alert the driver to objects far ahead in highway and country road driving situations while not over-alerting in dense city traffic.

The radar sensor uses the DIU to communicate the FDA alerts to the driver. This system can be configured through a current version of Bendix® ACom® Diagnostics software, for use by a fleet as a driver training tool with or without coordinating the data made available by Wingman Advanced. In addition to being a reminder of when a driver may be dangerously close to the vehicle ahead, the following distance alerts may also be configured to reinforce safe following distance habits taught by the fleet.

The FDA is based on the following interval between the host vehicle and the object ahead. In other words, this is the time required by the host vehicle to travel forward and reach the object's current location. With the exception of the volume, the FDA may not be adjusted by the driver through the DIU. A qualified technician must connect to the vehicle through the diagnostic port and run ACom® Diagnostics, in order to change the configuration. The volume can not be turned all the way down, but other adjustments may be made by the fleet. *See Section B1.3* for more details on volume adjustment.

The FDA system is intended only to alert the driver about following distance. For more information on alerts for forward objects with high relative velocities and sudden decelerations, *see Section B4.0: Impact Alert.*

Only objects detected in the vehicle's lane, traveling in the same direction, are considered valid objects for the FDA. For more information on stationary objects, *see Section B5.0: Stationary Object Alert.*

See Section 5.4: Configuring Bendix Wingman Advanced Following Distance Alerts.

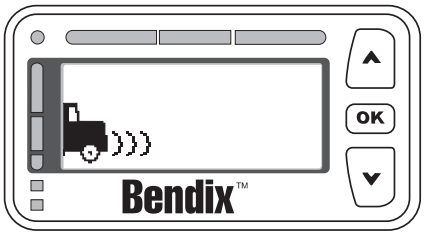
⚠ WARNING

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix® Wingman® Advanced™ system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

B3.1 Object Detected

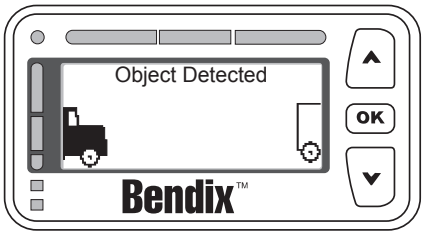
When there is no valid object detected and no other high priority alert is displayed, the DIU will stand by with the following screen:

(No LEDs Illuminated)



When a valid object is detected, and is outside the range of the first level of alert, and no other higher priority alert is displayed, the DIU will display the following and no audio tones will be issued. The distance to the object will be displayed in large characters in the white space at the center of the screen (not shown) in seconds, feet, or meters, depending on the menu-selected preferences. By default, seconds will be displayed.

(No LEDs Illuminated)

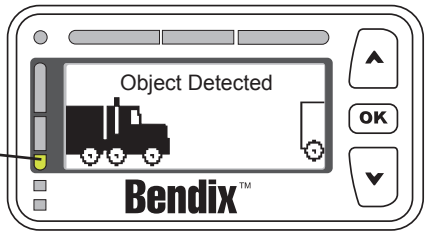


B3.2 Following Distance Alert (FDA) Level 1 *(Slow audible two-tone alert/single LED illuminated)*

When FDA Level 1 is issued, the following distance to the object/vehicle ahead has been reduced to the distance determined in the current configuration for FDA Level 1. The DIU will begin to give the driver audio and visual alerts for as long as the forward vehicle is in this zone and traveling at the same speed or slower.

The DIU will not display following distance units while in an FDA Level. For FDA Level 1, the audible alert will be a single repeating tone, and the visual alert is a single yellow LED and a screen with the vehicles slightly closer as shown below.

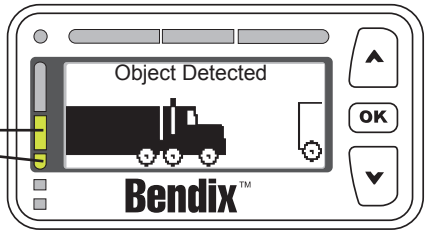
Single Yellow LED Illuminated



B3.3 Following Distance Alert (FDA) Level 2 *(Medium audible two-tone alert/two LED's illuminated)*

The DIU will give the driver audio and visual alerts for as long as the object/vehicle ahead is in this zone and traveling at the same speed or slower. The DIU will not display following distance while in an FDA Level. For FDA Level 2, the audible alert will be a repeating double tone, and the visual alert is two yellow LEDs and a screen with the vehicles closer as shown below.

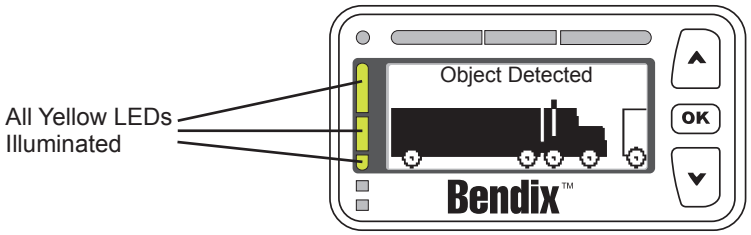
Two Yellow LEDs Illuminated



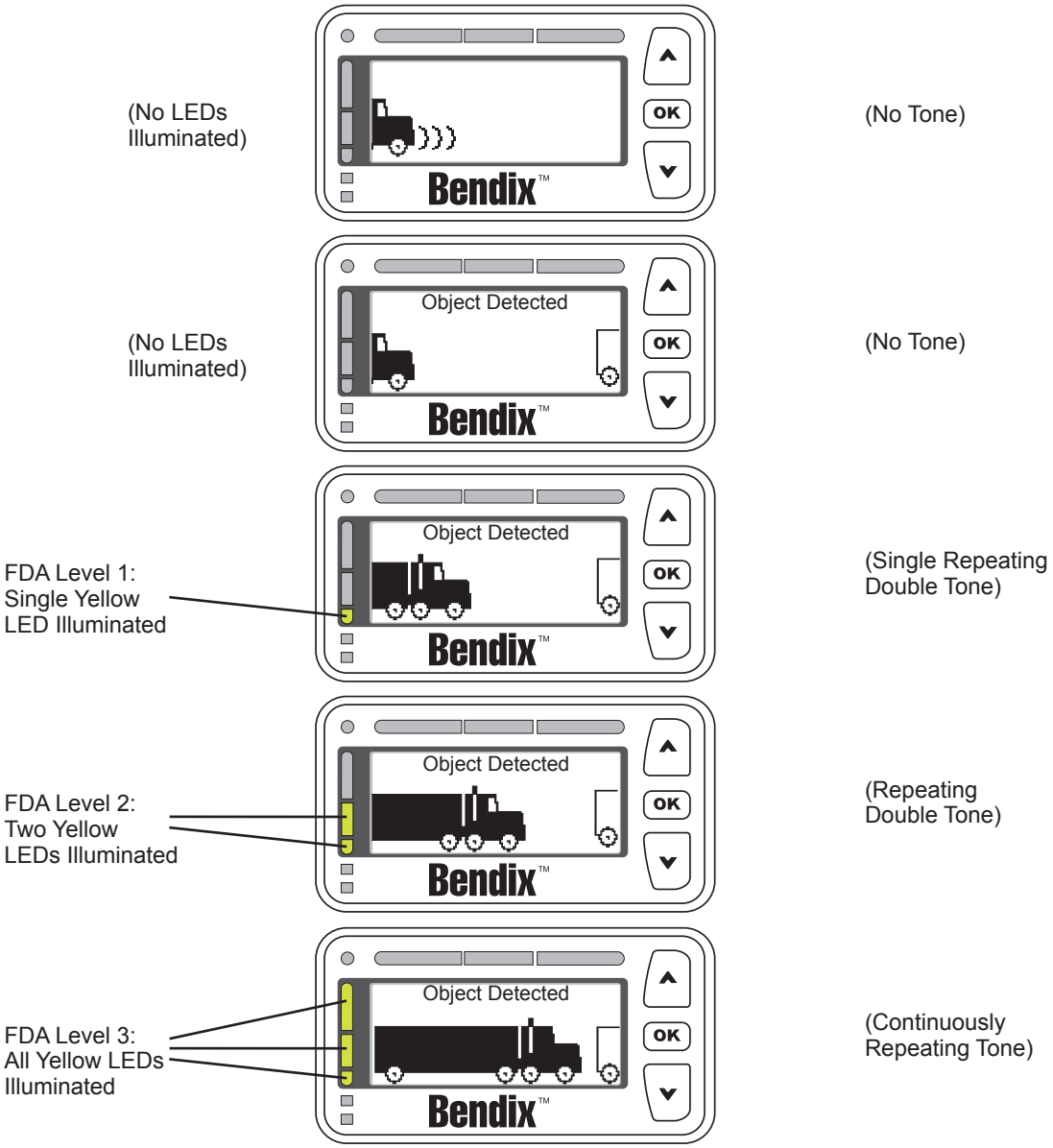
B3.4 Following Distance Alert (FDA) Level 3 *(Fast audible two-tone alert/three yellow LEDs illuminated)*

The DIU provides the driver with audio and visual alerts for as long as the vehicle ahead is in this zone and traveling at the same speed or slower. This is the closest and most urgent Following Distance Alert.

The DIU will not display following distance while in an FDA Level. For FDA Level 3, the audible alert will be a continuously repeating tone, and the visual alert is three yellow LEDs and a screen with the vehicles close as shown below:

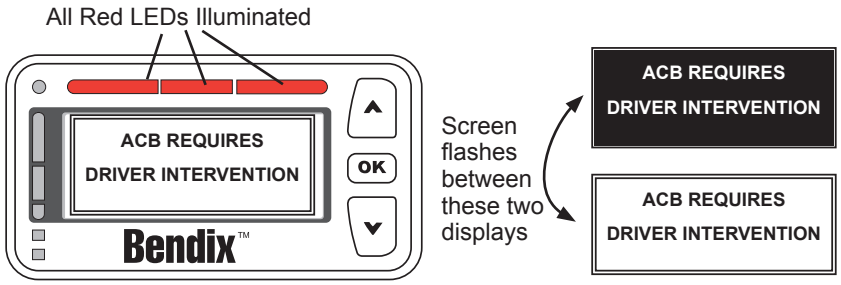


All five states of the FDA system can be seen together below.



B4.0 Impact Alert (IA)

The “Impact Alert”, uses a combination of distance to the vehicle ahead, plus high relative velocity, to decide when to issue a loud solid tone, as well as a visual indicator to the driver. The red LED bar across the top of the DIU will illuminate and “Wingman Adv. Requires DRIVER INTERVENTION” will flash using the two screens below:



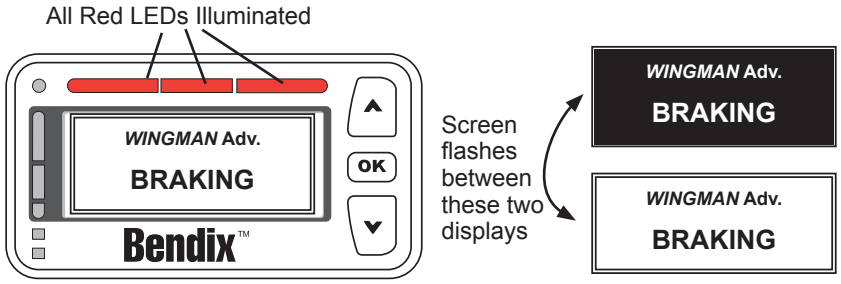
When the Impact Alert activates, the driver must immediately act to potentially avoid, or lessen the severity of, a collision.

The impact alert can not be configured or turned off.

NOTE: At most, the adaptive cruise control with braking feature of Bendix® Wingman® Advanced™ will apply up to one-third of the vehicle’s braking capacity. The driver must apply additional braking, when necessary, in order to maintain a safe distance from the vehicle ahead.

B4.1 Collision Mitigation

If a collision is likely to occur, and the collision mitigation feature activates the foundation brakes, the tone of the alert will typically change and the display will be as shown below. The driver must immediately act to potentially avoid, or lessen the severity of, a collision.



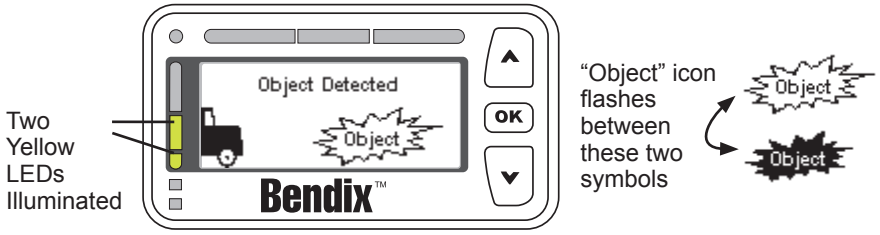
NOTE: At most, the collision mitigation feature of Bendix® Wingman® Advanced™ will apply up to two-thirds of the vehicle’s braking capacity.

B5.0 Stationary Object Alert (SOA)

Stationary Object Alert (SOA) is an alert given to the driver when the radar detects a sizeable, nonmoving metallic object in the vehicle's path of travel. To reduce the number of false detections, such as bridges and overhead signs, an advanced set of filters are put in place so the SOA will not warn on every stationary object.

The SOA can be configured to be on or off through the display.

If a SOA is issued, the DIU will very briefly send out an alert identical to a very brief FDA Level 2: continuous tone and two yellow LEDs, with the display image switching between the two shown below.

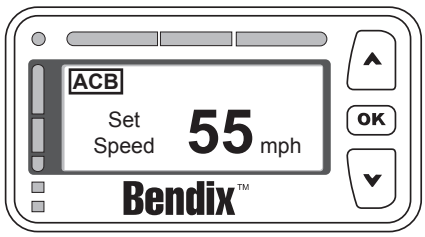


B6.0 ACB Icon

The ACB icon appears in the upper left-hand corner of the DIU's screen to indicate to the driver that the adaptive cruise control with braking feature of the Bendix® Wingman® Advanced™ system is ready and able to intervene.

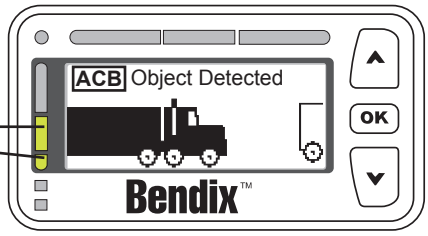
Once the driver sets cruise, the DIU will display the set speed and the ACB icon as shown below.

(No LEDs Illuminated)



When a forward vehicle is detected and either the distance to the vehicle or a following distance alert is shown, the ACB icon should remain on the screen if the adaptive cruise control feature of Wingman Advanced is still engaged and ready to intervene.

Two Yellow LEDs Illuminated



NOTE: If the ACB icon is not displayed on the screen, the driver must assume that the adaptive cruise control with braking feature of Wingman Advanced is not ready or able to intervene!

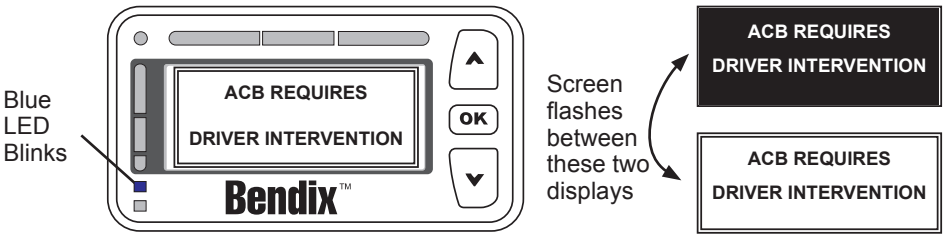
Driver Interface Unit: Displays & Alerts

B7.0 Brake Overuse Alert

Using cruise control on downhill runs is the primary cause for this alert to be activated. **CAUTION**

Cruise control should *NOT* be used on downhill grades. Approach grades as you would normally, with the appropriate gear selected and at a safe speed.

To guard against foundation brake overuse by the adaptive cruise control with braking feature of the Bendix® Wingman® Advanced™ system, the frequency of foundation brake interventions is monitored. If the system detects a situation where the brakes are being applied too frequently by the system in a given time period, the brake overuse alert will activate. This is designed to help prevent overheating of the brakes, which may lead to brake fade and reduced vehicle braking capability. In this situation, the Brake Overuse Alert will flash a message requesting driver intervention. Also, an audible alert will sound and a blue LED will blink on the Bendix Driver Interface Unit (DIU), as illustrated below:



This alert will continue for 15 seconds, during which time the driver should step on the brake or turn off cruise control using the cruise control on/off switch.

If the system detects that the driver has intervened within 15 seconds after a brake overuse alert

(Typically by applying the brakes, or cancelling cruise control)

- The intervention cancels cruise control.
- After a Brake Overuse Alert, for a period of time (typically 20 minutes), the Wingman Advanced system ***will not use the foundation brakes*** when intervening. The system will be limited to de-throttling the engine and applying the engine retarder during this time. **Note: In all cases, the driver still has the ability to apply the foundation brakes if necessary. The driver should take care since overheated brakes may reduce the vehicle's braking capability.**
- The time period for this mode is measured from the time the Brake Overuse Alert was activated and lasts approximately 20 minutes.
- Note: The driver will continue to receive all three alerts (FDA, Impact, and Stationary Object).
- Additionally, the DIU message will change to "ACB Braking Overuse" and the blue LED will remain lit, as shown below:

At the end of the "cooling-off" period, the "ACB Braking Overuse" message and the blue LED will turn off.

If the system does not detect an intervention by the driver within 15 seconds after a brake overuse alert

- **The system will shut itself off, and set a Diagnostic Trouble Code (DTC).**
- **All intervention features of Wingman Advanced will be disabled until the next ignition cycle.**
- Note: The driver will continue to receive all three alerts (FDA, Impact, and Stationary Object).
- **Note: In all cases, the driver still has the ability to apply the foundation brakes if necessary. The driver should take care since overheated brakes may reduce the vehicle's braking capability.**

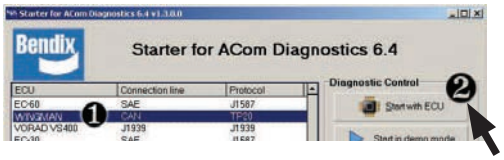
APPENDIX C - HOW TO READ AND RESET THE BENDIX® WINGMAN® SYSTEM DIAGNOSTIC TROUBLE CODES USING BENDIX® ACOM® DIAGNOSTICS SOFTWARE

Appendix C

How to Read and Reset Wingman® Diagnostic Trouble Codes with ACom® Diagnostics

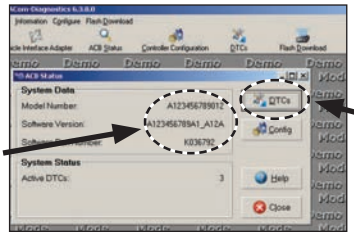
1. Click Bendix® ACom® desktop icon

2. Select “Wingman” from the starter screen. Click “start with ECU”



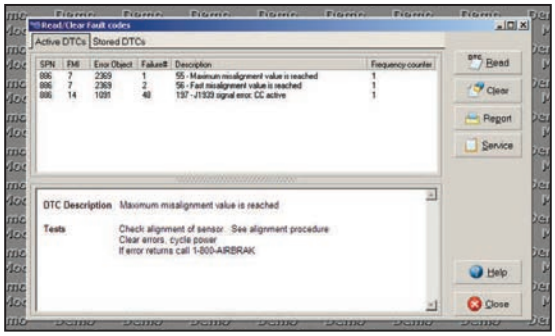
3. Read Wingman® Advanced™ status screen.

A. Take Note of: Model #, Software Version, Software P/N, Active DTCs

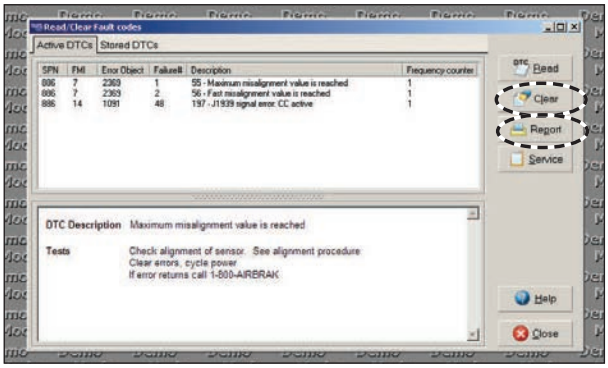


B. Click DTCs

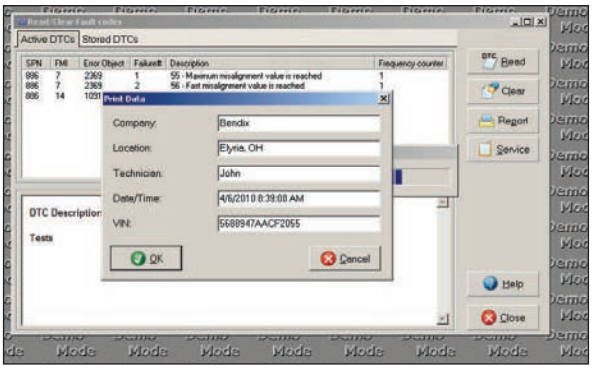
4. Click "Read". Active DTCs (diagnostic trouble codes) are shown along with descriptions of the codes and tests that can be run to troubleshoot the code. You can select “stored DTCs” also, to show inactive DTCs.



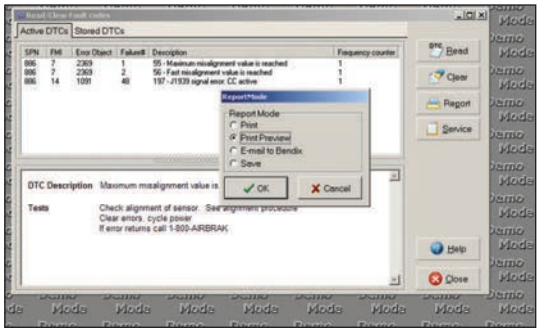
5. Click “clear” to clear all active DTCs. Click “Report” to get the ACom report.



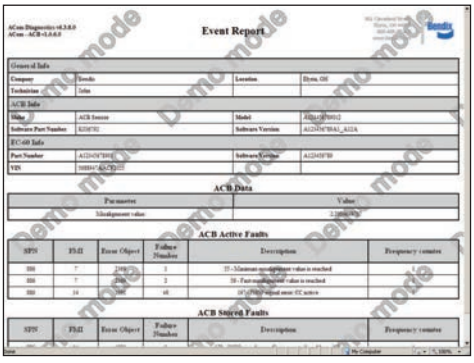
6. Fill in the requested information: Company, location, technician, date/time, VIN, and click “OK”



7. Select how you want the report displayed or printed. Then click “OK”



8. The event report is generated. This can be saved if desired.



9. You can also use the shortcut menu at the top of the screen and select: Advanced status; DTCs; and Controller Configuration.

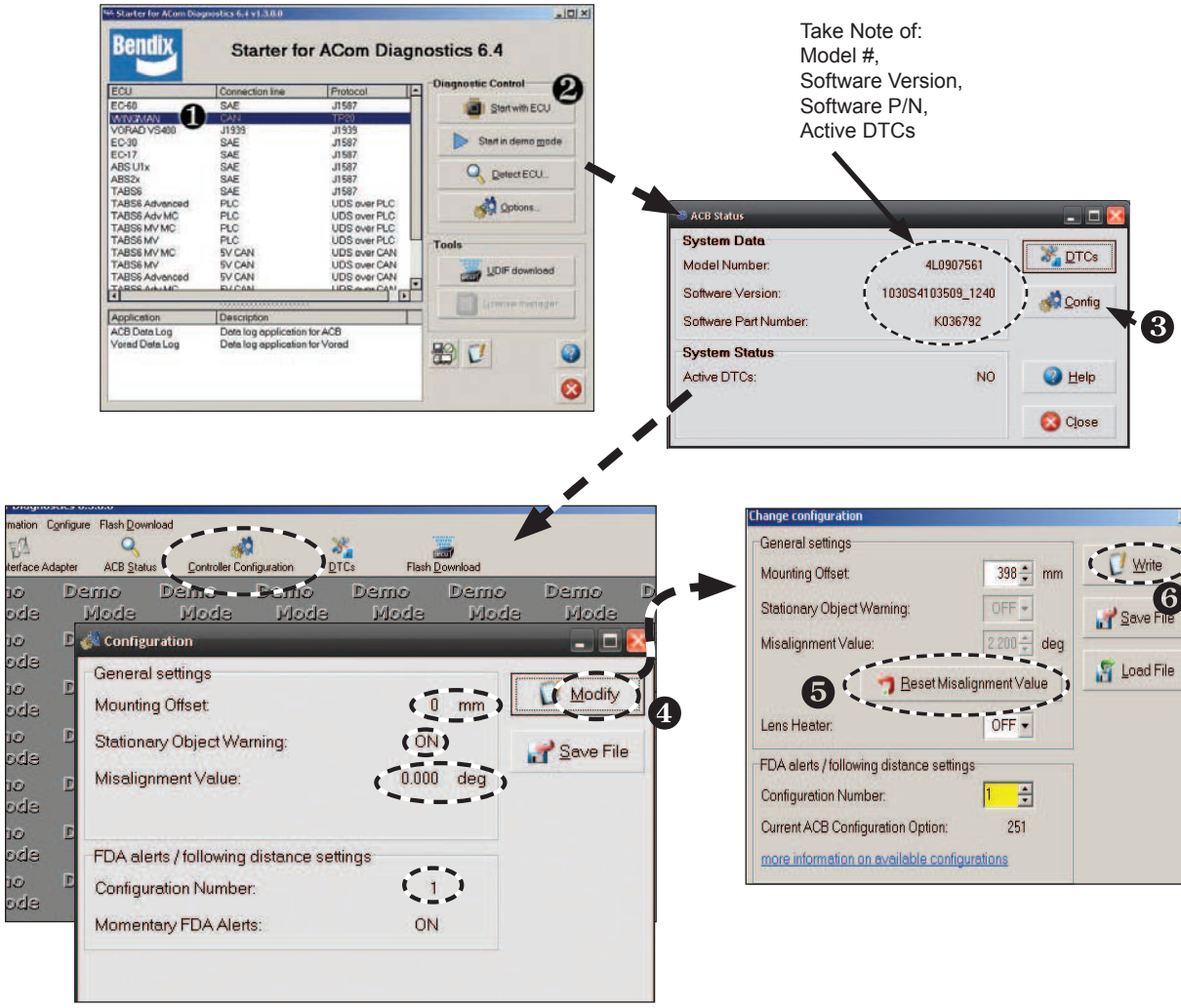
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

Appendix D

How to Read Key System Indicators and Reset Alignment Values

Read System Key Indicators (Configuration)

1. Start Bendix® ACom® Diagnostics and connect to vehicle.
2. Select “Advanced” and Click “Start with ECU” to display the “Advanced Status” window.
3. Click “Config” to display the indicators



System Key Indicators

Attribute	Description					See Section:
Mounting Offset	This value should equal 0 if the radar sensor is mounted on the center line of the vehicle. If the service technician believes the radar sensor should be mounted offset from center, call 1-800-AIR-BRAKE (1-800-247-2725), option 2.					6.10
Stationary Object Warning Indicator	This is a status indicator for the function of stationary object warning. Available for use in Bendix® Wingman® Advanced™ system versions since 2010.					1.7
Alignment Value	Trouble code will be set if value is -1.3º or less	Abnormal operation: -0.8º	Normal operation: normal	Abnormal operation: 0.8º	Trouble code will be set if value is 1.3º or more	6.7
Configuration Number	This indicates the distance setting and following distance alert that are configured for the vehicle. Refer to Table 7 for setting information.					5.4

How To Reset The “Alignment Value”

4. From the configuration window shown above, click “Modify.”
5. From the Change Configuration window, select “Reset Alignment Value.”
6. Click “Write.”
7. Cycle the vehicle ignition power to complete the process.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

Appendix E

Bendix® FLR20™ Radar Mounting

E. BENDIX® FLR10™ RADAR SENSOR MOUNTING CLEARANCE

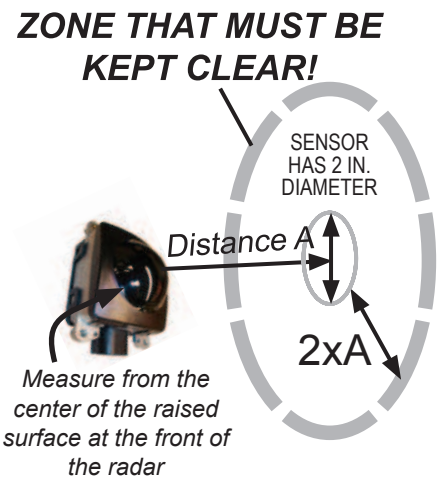
⚠ CAUTION

Vehicle equipment, including bumpers, deer guards, etc. must not infringe upon the zone used by the radar sensor to emit and receive radar waves. Failure to comply with this requirement will impair the function of the radar. Only vehicle OEM-approved covers and/or cover panels may be installed directly in front of the radar.

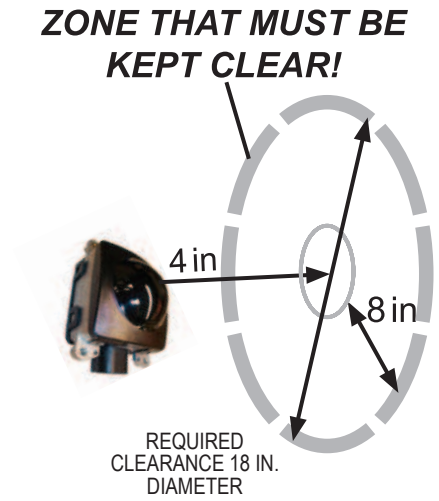
For proper operation of your Wingman Advanced system, adhere to the following guidelines:

- The radar sensor assembly should be OEM-installed on the vehicle following all OEM specifications.
- The radar's field of view must NOT have interference from any other vehicle components such as bumpers, cow-catcher bumpers, engine blankets, seasonal decorations, or any other commonly mounted front-of-vehicle components. The radar signal is emitted from the front of the sensor with a spreading beam. In order to ensure that no adverse interference is experienced from bumpers or other nearby vehicle equipment, a suitable clearance must be maintained around the radar. This clearance must be maintained regardless if the vehicle is stationary or in motion. See the diagram below for a general guide - the area to keep clear from all sides of the radar emitting surface is twice the distance from the radar.

NOTE: Bendix does not certify nor offer warranty on Bendix Wingman systems where system performance is affected by beam obstructions of any kind or unapproved post-production covers. This document gives general guidelines that will work for most vehicles; exceptions may exist.


ZONE THAT MUST BE KEPT CLEAR!
SENSOR HAS 2 IN. DIAMETER
Distance A
2xA
Measure from the center of the raised surface at the front of the radar

Example: If an obstruction is four inches in front of the Bendix FLR10 radar, it must be outside of a zone 18 inches in diameter.



The only exceptions are vehicle OEM-approved covers

Appendix F

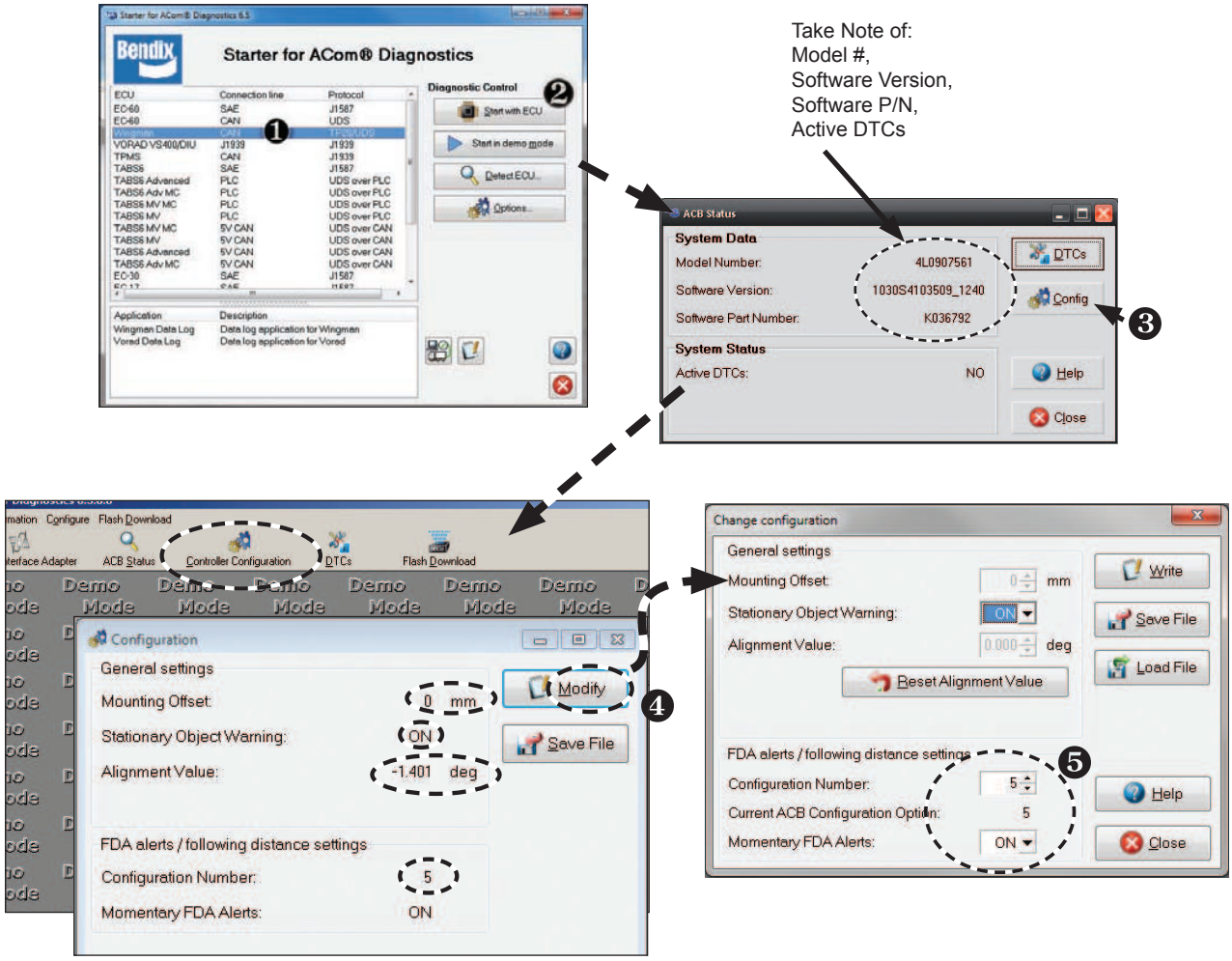
How to Change the Following Distance Alert (FDA) Settings and Enable Momentary Beeping

Steps to display the indicators

1. Start Bendix® ACom® Diagnostic Software and connect to vehicle.
2. Select “Advanced” and Click “Start with ECU” to display the “Advanced Status” window.
3. Select “Config” to display the indicators

Steps to CHANGE the indicators (Important: You will need the correct Bendix ACom Diagnostic Software license key from Bendix. Call 1-800-AIR-BRAKE (1-800-247-2725, option 2) and speak with the Tech Team if you do not already have the license key.

1. Select “Modify”
2. Modify the configuration number to change the FDA settings and also enable or disable momentary FDAs as needed.



Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725, option 2) for troubleshooting assistance.

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